January 13, 1958

Paper Trade Journal

University Microfilms
Att: E B Power
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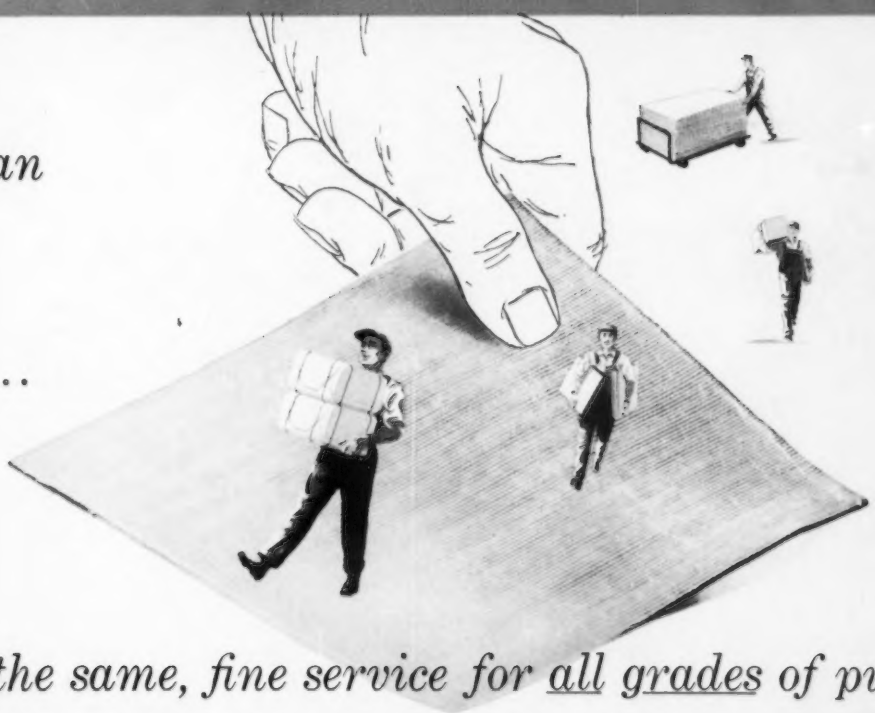
Ann Arbor, Mich.

- Semi-Automatic Bleach Liquor System at Mechanicville
- Recent Improvements in the Cold Soda Pulping Process
- Principles and Methods of Screening Groundwood
- Digester Control No Longer a Problem at Southland Paper

...then Gottesman enters the picture...



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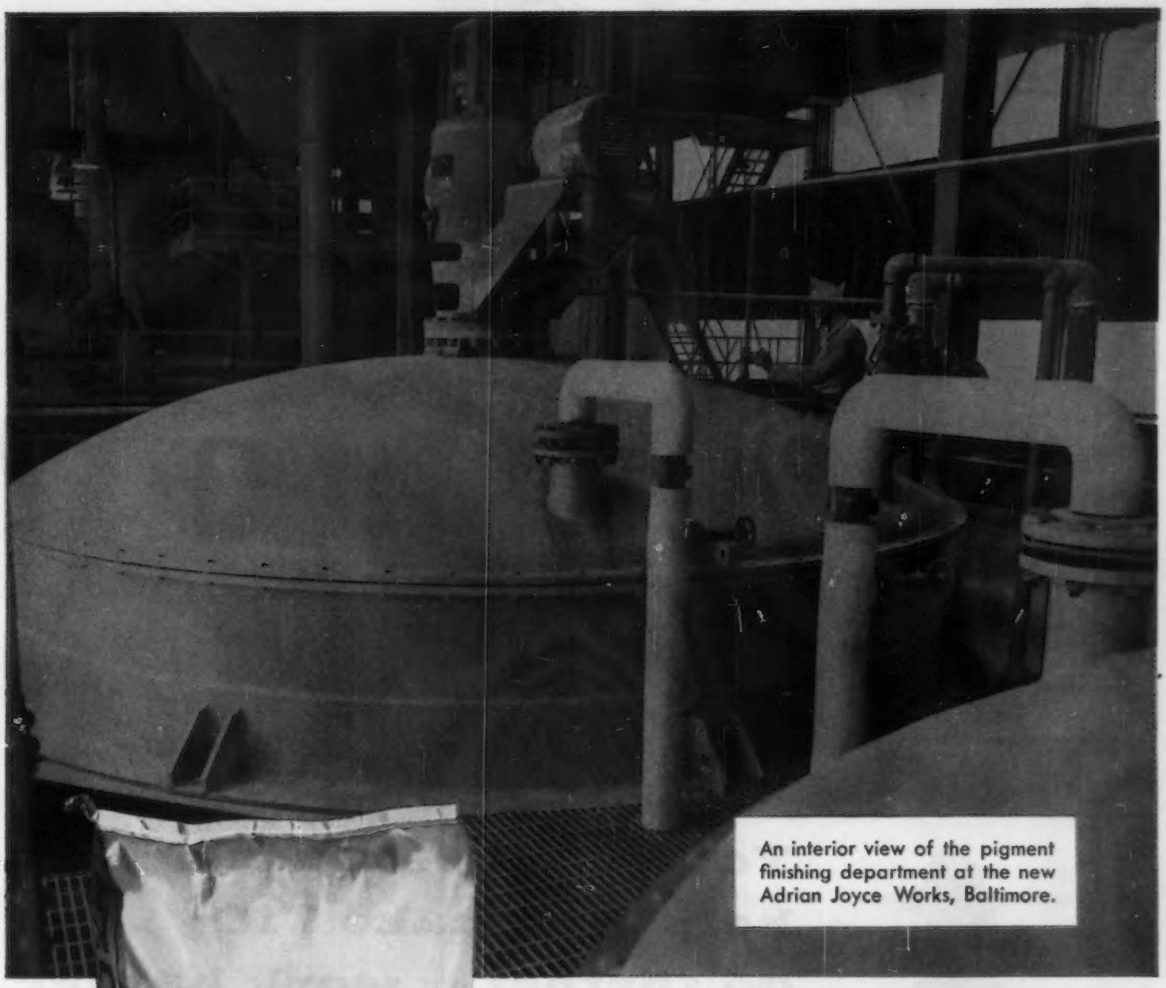

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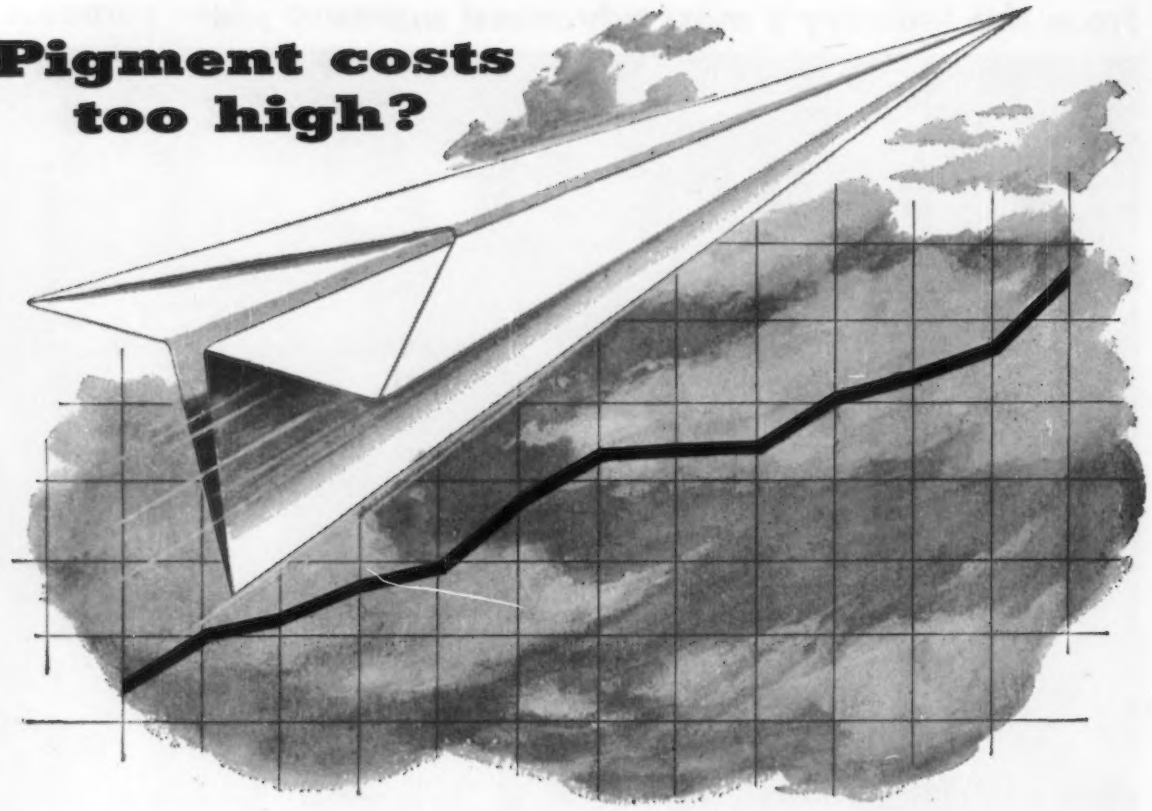

Your Celite engineer can help you make TiO_2 go further...work harder

● If you are using TiO_2 alone in your furnish, call in a Celite* engineer. He'll be glad to show you how you can reduce pigment cost substantially by substituting Celite for a portion of the TiO_2. His test runs will also demonstrate that brightness is increased by this combination because Celite contributes its own intrinsic high brightness (up to 90) and also helps retain more TiO_2 in the sheet.

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*Celite is Johns-Manville's registered trade mark for its diatomaceous silica products. In the paper industry, it enjoys wide use in the control of pitch, to increase opacity and brightness and to provide better ink receptivity and absorption.

Suggested use of Celite with TiO_2

TiO_2 Proportion	Suggested Combination
Up to 2%	Add 1% to 5% Celite
5%	4% Celite—3% TiO_2
10%	5%-10% Celite—5% TiO_2

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REMEMBER THESE DATES . . .

JAN. 23: Western Michigan University's Annual Pulp & Paper Conference, Kalamazoo, Mich.

JAN. 29-31: Canadian Pulp & Paper Assn. Annual Meeting at Mount Royal Hotel, Montreal, Canada.

FEB. 16-21: Paper Week in New York.

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January 13, 1958, *Vol. 142, No. 2*

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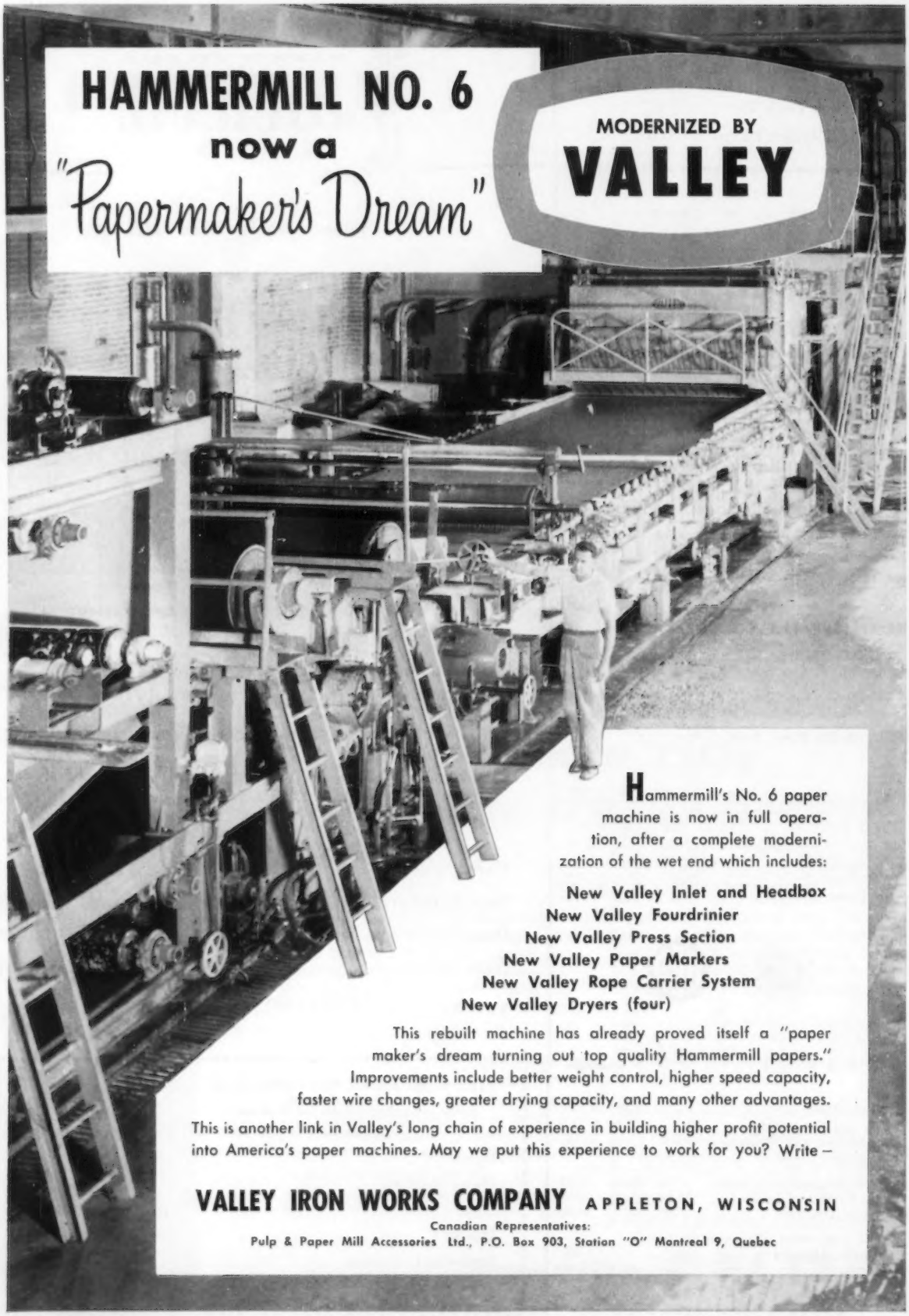

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How Indoor Relative Humidity Vitally

"Dry" Air — Dry Stock — A Wintertime Problem

EVERY PRODUCTION superintendent in the industry is, by experience, familiar with one or more of the following wintertime headaches:

1. Curling of stock.
2. Cracking or breaking at creases of folding boxes, cartons, corrugated and solid fibre containers.
3. Loss of package and container strength.
4. Production delays when sheets fail to go through machines smoothly.
5. Excessive scrap losses.
6. Off-register printing.
7. Off-register die cutting.
8. Gluing failures.
9. Customer complaints.

All of the above listed wintertime problems have a common cause — dry paper caused by low indoor relative humidities.

Whenever you heat air, without adding moisture, its relative humidity drops. Table 1 shows that zero degree outdoor air at 75% relative humidity will have a relative humidity of *but 4.4% when heated up to 70 degrees indoors.* And, Graph A shows indoor relative humidities in a typical heated, but *unhumidified,* plant. Even though the theoretical relative humidity should be 4.4% in your plant the actual observed humidity will be higher because you are getting "free" humidification from the moisture given off by the paper. This "free" humidification is very expensive stockwise and productionwise.

How Relative Humidity Affects Paper Moisture Content

In technical language, paper is *hygroscopic.* Its moisture content is governed by the relative humidity of the surrounding air as shown in Table 2. When the relative humidity goes down, paper gives up moisture to the air. When R.H. goes up, paper absorbs moisture from the air.

A moisture content range of 5% to 7% is essential to maintain satisfactory strength and workability of paper. This requires an indoor rela-

TABLE 1
HOW INDOOR HEATING REDUCES INDOOR RELATIVE HUMIDITY AND DRIES OUT PAPER*

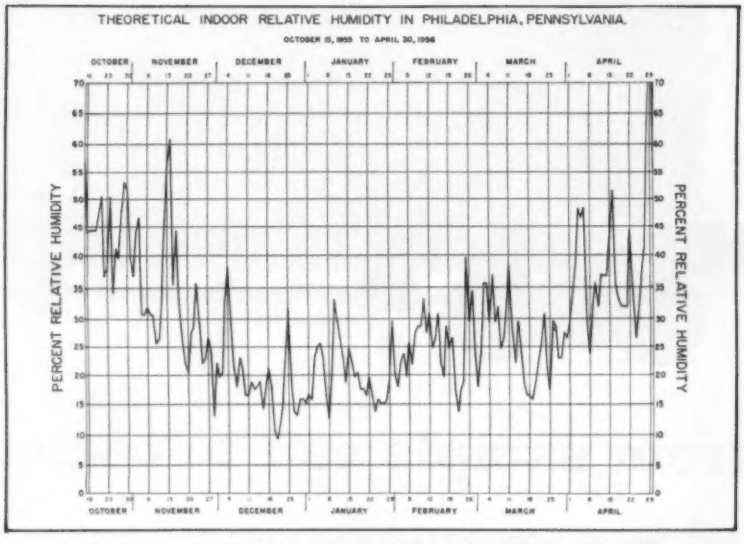
Effect of Indoor Heating Upon Indoor Relative Humidity and Moisture Content of Kraft Wrapping Paper.

Outdoor Temperature Degrees	Indoor Temperature 70°	
	Indoor Rel. Humidity %	Approx. Moisture Content of Paper %
−20	1.5	0.5
−10	2.5	0.8
0	4.4	1.2
10	7.2	2.2
20	11.6	3.3
30	18.1	4.3
40	26.8	5.3
50	38.3	6.4
60	54.0	8.0
70	75.0	11.6

NOTE: This table assumes an outdoor relative humidity of 75%. When outdoor relative humidity is less, as is common, indoor R.H. will also be less. Indoor temperatures higher than 70° will also cause lower relative humidities.

Moisture contents of different types of paper will vary slightly from those shown in the table but will follow an identical pattern.

**For a complete explanation of relative humidity ask for Armstrong Bulletin No. 500.*



GRAPH A — "DRY" INDOOR AIR IS A WINTERTIME PROBLEM

This graph shows the theoretical average daily humidity inside a heated but *unhumidified* plant in Philadelphia. Paper and board in this plant is constantly losing and absorbing moisture, causing constant variation in size, strength and flatness. The most severe problems occur at periods of very low relative humidity occurring during the heating season.

TABLE 2 — MOISTURE CONTENT OF PAPER AT VARIOUS RELATIVE HUMIDITIES

(Authority — U.S. Bureau of Standards)

Material	Description	% Relative Humidity								
		10	20	30	40	50	60	70	80	90
M. F. Nwsprt.	Wood Pulp 24% Ash	2.1	3.2	4.0	4.7	5.3	6.1	7.2	8.7	10.6
HMF Writing	Wood Pulp 3% Ash	3.0	4.2	5.2	6.2	7.2	8.3	9.9	11.9	14.2
White Bond	Rag—1% Ash	2.4	3.7	4.7	5.5	6.5	7.5	8.8	10.8	13.2
Com. Ledger	75% Rag 1% Ash	3.2	4.2	5.0	5.6	6.2	6.9	8.1	10.3	13.9
Kraft Wrapping	Coniferous	3.2	4.6	5.7	6.6	7.6	8.9	10.5	12.6	14.9

TABLE 3

Effect of Bag Storage Relative Humidity on Stretch and Tear Resistance of paper bags in percent of values at 70°F and 65% R.H.

RELATIVE HUMIDITY	STRETCH		TEAR RESISTANCE
	Machine Direction	Cross Direction	
65%	100%	100%	100%
55	85	85.5	90.5
45	75	75.5	85.5
35	65	66.0	81.0
25	54.5	56.0	74.5
15	43	47.5	70.0

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Affects Your Production and Profits

tive humidity of about 40% to 50%, depending upon the composition of the paper — a relative humidity impossible to maintain in the wintertime without automatic controlled humidification.

How Moisture Content Affects the Qualities of Paper

The moisture in a sheet of paper or paper board lodges between the microscopic fibrils of which a paper fiber is made, and paper is, of course, made of fibers that are more or less parallel to each other. The amount of moisture between the fibrils affects the qualities and workability of the paper in the following ways.

Dimension. When moisture enters the fiber, it forces the fibrils apart, increasing their diameter, and when paper dries out, the moisture leaves the fiber, causing it to shrink. This shrinkage causes the sheet itself to get smaller. Shrinkage is greater across the grain than with grain.

Shrinkage is responsible for off-register printing when the first color is applied at, say, 50% R.H., and the second color is later applied after the stock has been exposed to air at some lower relative humidity.

Flatness. Moisture loss from the exposed side of a sheet causes the top of the sheet to shrink more than the bottom, and produces curl. This exposes the next sheet to the same conditions, and so on. Or, moisture loss from the sides of a skid of stock causes tight edges.

Strength. The moisture between the fibrils of the fibers acts as a lubricant that makes it possible to bend the fibers without breaking. This is why a sheet has good bending qualities at 50% R.H. and 5 to 7% moisture content, but may crack when bent at very low relative humidities.

Moisture content also has a major effect on tear and tensile strength as shown in Table 3.

Gluing. When a sheet is very dry during cold weather, it greedily drinks water from the glue — so fast, in fact, that the glue is dried before it can make a good contact with the sheet.

Contrast this with a 5 to 7% moisture content sheet at 50% R.H. Moisture leaves the glue more slowly, and the glue can make good contact with the sheet long before the moisture is absorbed.

Other Factors Affected by Relative Humidity

Cutting Dies. Wood that holds the cutters in position is hygroscopic, just like paper. To insure dimensional stability, the die should be prepared, stored and used under conditions of constant relative humidity.

Printing Press Rollers. Composition rollers swell as moisture content increases, shrink as it decreases. This affects roller life, ink distribution.

Static Electricity. Printers are particularly familiar with this problem. But, thin sheets, especially, are affected by static when passing through any machines. They cling together or to machine parts, or "spring apart", causing all kinds of difficulties. A relative humidity of 50% puts an invisible film of moisture on machine parts, conducting static to the ground.

What to Do About It

The only way to maintain paper moisture content in the desirable 5% to 7% range during the wintertime is to employ automatic controlled humidifiers throughout storage and processing areas. (And, your customers should store containers, boxes, cartons, bags and paper in humidified areas.)

Humidification will pay for itself over and over again through reduction in scrap losses, elimination of production difficulties and reduction in customer complaints — the cost of two rejected carloads of shipping containers would pay for a humidifier installation in most plants.

The Case for Armstrong Steam Humidification

Armstrong Steam Humidifiers provide large humidifying capacity at low cost by discharging clean, dry steam directly into the atmosphere. Their many advantages follow:

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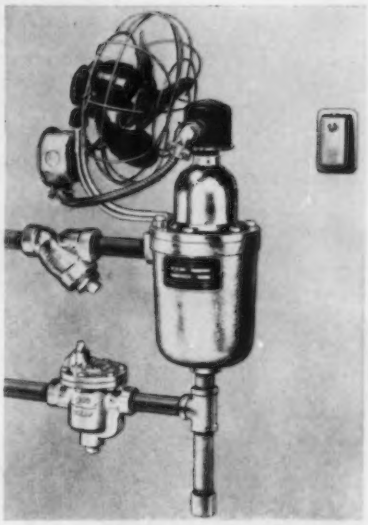
2. **Low Initial Cost**—Armstrong Steam Humidifiers commonly pay for themselves in one season.
3. **Low Operating Cost**—100,000 cu. ft. of space can be humidified for 24 hours for about $1, on the average.
4. **Low Maintenance Cost**—fan motor is permanently oiled, solenoid valves are glass-wound, humidistats are designed for years of service.
5. **No Clogging**—there are no mineral impurities to clog nozzles and cause frequent cleaning.
6. **No "Fallout"** of moisture or mineral "dust."



Armstrong C-2 electrically operated steam humidifier complete with fan, humidistat, strainer and steam trap. A larger capacity model of identical design is also available.

GET THE FACTS

Bulletin 506 tells how relative humidity affects your profits. It contains: effects of relative humidity on paperboard quality and workability . . . table of paper moisture content at various degrees of relative humidity . . . table of stretch and tear resistance . . . reports by users of Armstrong Steam Humidifiers . . . features, prices and capacities of Armstrong Steam Humidifiers . . . how to get a free humidification survey.

For copies, call your local Armstrong Representative, or write:

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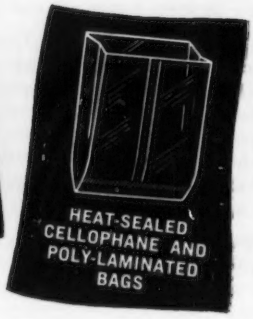

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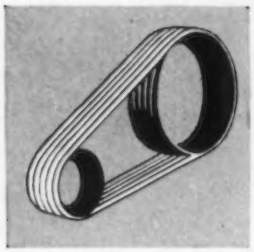

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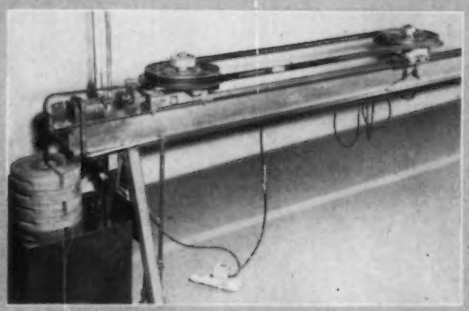

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✓ Trims paper and core evenly — cleanly
✓ No crushing — no cuts on bias
✓ Minimum waste at end cut trim

High speed continuous running band knife cuts rolls or packs with clean, dust-free, non-ragged edges for complete production satisfaction. Packs retain round or square shape because there is no binding and "logs" are not squashed in cutting process. End trim cut results in minimum waste.

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✓ Interfolded towels
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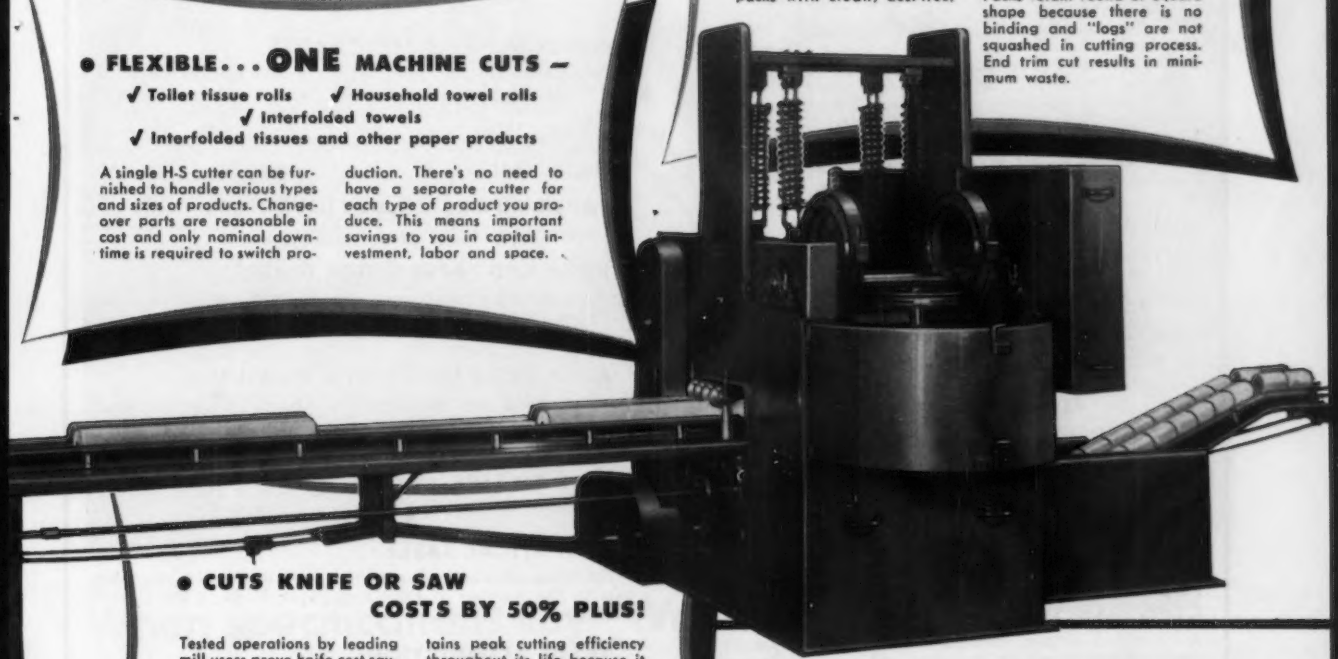

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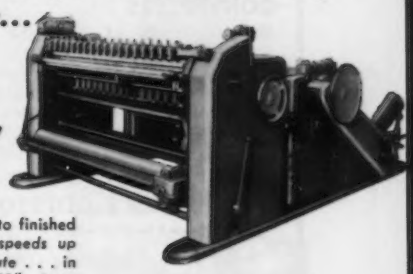

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1958 — Lockwood's Directory — 1958

of the Paper and Allied Trade 83rd Annual Edition

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PULP AND PAPER MILLS UNITED STATES AND CANADA

Comprehensive reports including name of Company, Officers and Operating Executives.
Location of mills shown in geographic order. Mills identified to show whether Paper—Ground Wood—Sulphite Pulp—Sulphate Pulp—Soda Pulp—Semi-Chemical Pulp, etc.
Products manufactured. Total production in pounds per twenty-four hours.
Types of mill equipment and kind of power used.
Shipping point, railroad siding, post office, nearest bank, money order and telegraph office. Bus lines. Airport. Telephone. Highways. U. S. and State route numbers. In Canada: Kings and Provincial route numbers.

State and Provincial Maps keyed to indicate number of Pulp and Paper Mills in each City or Town.

MILL OFFICIALS—

An alphabetical list of the names of officers and operating executives of the mills including their connections.

LISTS OF NEW AND IDLE MILLS

CLASSIFIED SECTION

In this section are shown in alphabetical order the products made by all of the Pulp and Paper mills in the United States and Canada.

CITY ADDRESSES

In this section are shown the names and street addresses of Pulp and Paper Mills and Mill Agents maintaining offices in the principal cities of the United States and Canada.

Reports of the Paper and Pulp Mills in Latin America and Philippine Islands.

PULP AND PAPER MILLS AND CONVERTERS EQUIPMENT AND SUPPLIES

A classified section showing machinery, equipment and supplies purchased by the pulp and paper mills and the converters of paper products, with names and addresses of the manufacturers. An alphabetical list of Leading Trade Names with names of owners.

CONVERTERS

Manufacturers of products made from paper, card board, moulded pulp, etc. This section is geographically arranged by States and reported as follows: Name of company. Location of plant. Name of officers and operating executives. Types of mill equipment. Kind of products made.

CONVERTERS' PRODUCTS

Alphabetically classified including the names and addresses of concerns manufacturing products made from paper, card board, moulded pulp, etc., such as bags, boxes, cups, envelopes, glazed and coated paper and board specialties, papeteries, prepared roofing, tablets, pads, tags, toilet paper, towels, vegetable parchment, wall paper, waxed paper, etc., etc.

GENERAL PAPER MERCHANTS

Geographically arranged by States. Keyed to show dealers who maintain stores. Dealers who sell from mill direct. Merchants who sell from storage or warehouses. Merchants in other lines who carry paper as a side line. Concerns that are branches of houses located elsewhere. Fine Paper. Coarse Paper. Broker.

PAPER EXPORTERS AND IMPORTERS

Geographically arranged by States.

RAGS AND PAPER STOCK DEALERS

A selected list in geographic order of dealers in Rags, Paper Stock, etc. Keyed to show stocks handled. Importers are indicated.

RAGS AND PAPER STOCK CONSUMED

Kind and grade of Rags and Paper Stock Consumed by the mills in the United States and Canada. List of Purchasing Agents.

PULP TESTERS

Approved by certified pulp tester's bureau.

STATISTICAL TABLE

Showing number of concerns owning mills, together with the number of Pulp and Paper Mills in the United States and Canada.

TRADE ASSOCIATIONS

In the paper and allied trades of the United States and Canada.

WATERMARKS AND BRANDS

Alphabetical list of watermarks and brands used in the American paper trade with names and addresses of owners.

WOOD PULP AGENTS

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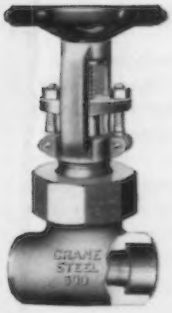

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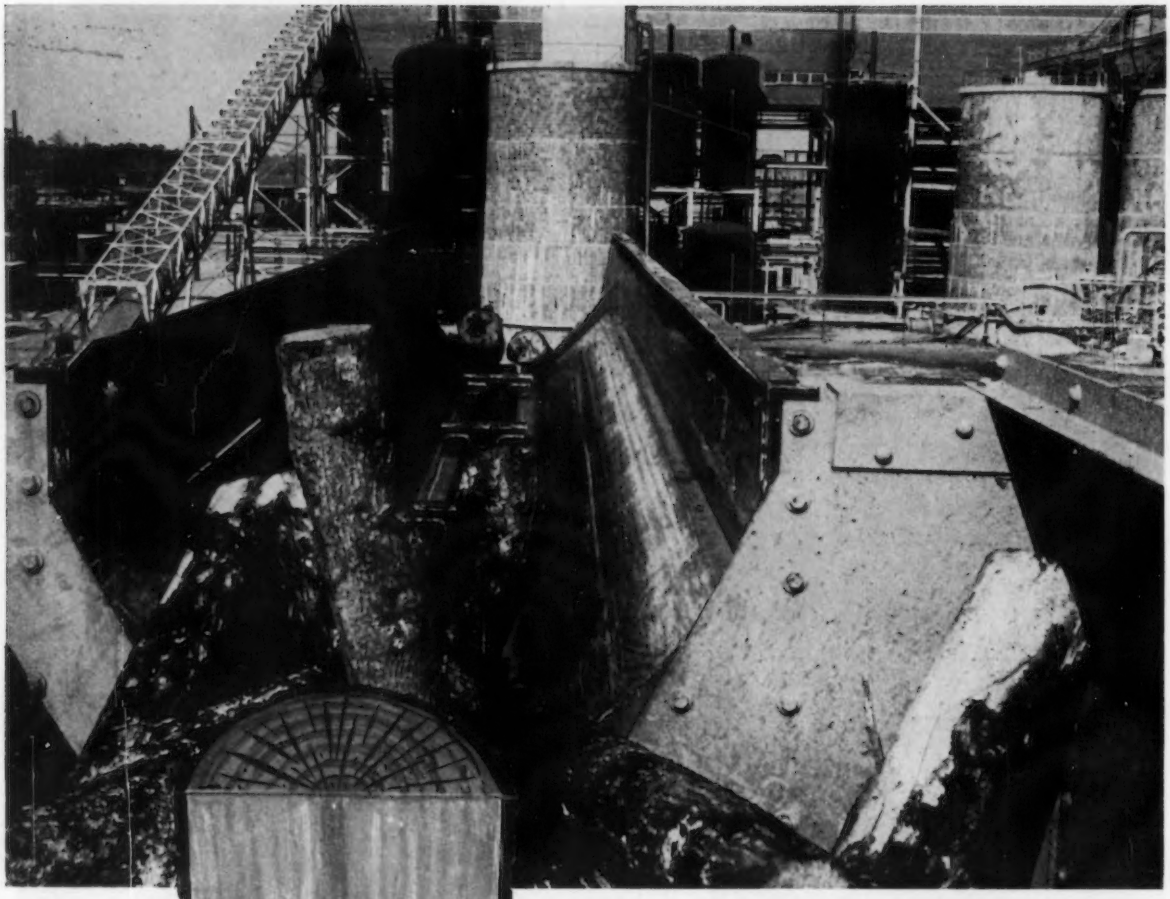

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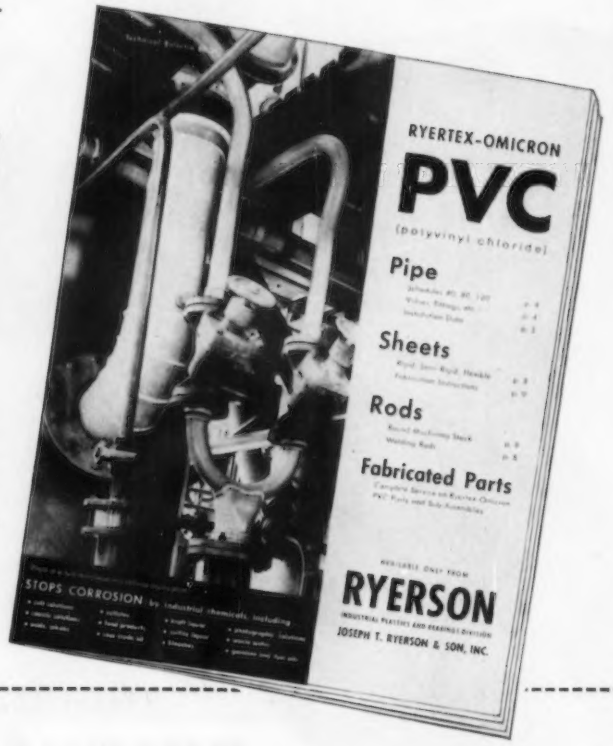

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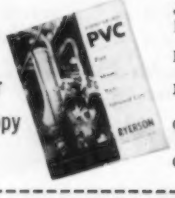

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CZ Investigating Newfoundland Mill

A proposal by Crown Zellerbach Corp. to explore the possibility of building large pulp and paper mills in Newfoundland was announced early in January. The proposal has been approved by the Newfoundland Cabinet and will shortly be submitted to the Provincial Assembly for confirmation.

Crown Zellerbach contemplates building facilities producing at least 400 tons of newsprint and up to 2,000 tons of pulp a day if its studies prove the economic feasibility of undertaking manufacturing operations in Newfoundland. Sufficient government timberlands in Newfoundland and Labrador to support such newsprint and pulp mills would be reserved for the company during its explorations.

If CZ decides to go ahead, it would develop manufacturing facilities as rapidly as the markets served by the new mills could absorb their production. The Newfoundland government, on its part, would guarantee sufficient timber to sustain the company's mill development program. This arrangement provides for maximum time-limits by which Crown Zellerbach must start various manufacturing phases or release the timber reserved for such phases to the government.

On the newsprint side of the project, Crown Zellerbach would complete its explorations and decide on building a mill within two years after the Newfoundland Assembly confirms by statute the company's agreement with the government. A mill producing at least 200 tons of newsprint a day would be completed within three years after an affirmative decision. Expansion of the newsprint mill to at least 400 tons a day would be envisaged sometime within the following seven years.

On the pulp side of the project, Crown Zellerbach would complete its explorations and decide whether to start construction of a 500-ton-a-day mill sometime within a 12-year period after enactment of the statute. Expansion of the pulp mill to 1,000 tons a day would be envisaged sometime within a subsequent five-year period—to 1,500 tons within the next five years—and to 2,000 tons within a third five-year period.

The wood supply for the newsprint and pulp mills would be provided CZ by 99-year renewable leases on government timberlands in southeastern Labrador and in the eastern and southeastern parts of the Island of Newfoundland. The Newfoundland timber lease would become effective when the company decides to build the newsprint mill, and the Labrador lease when it starts construction of the pulp mill. Both timber leases would be closely related to the sustained-yield requirements of Crown Zellerbach's mill development program which at maximum capacity could require an estimated 1,250,000 cords of wood a year.

The timber leases would provide for payment to the government of two dollars per square mile annual ground rental, and for stumpage payments of one dollar per cord of wood cut for processing within the province and two dollars per cord of wood exported without being processed within the province. These stumpage rates would be adjusted annually in accordance with newsprint price changes.

"The actual timing of starting new production facilities in Newfoundland would naturally depend on future market conditions," said A. B. Layton, CZ president.

Little Rapids Pulp Acquires New Financing

Little Rapids Pulp Co., Green Bay, Wis., has acquired new financing totalling $500,000, according to Charles N. Egan, president.

The firm operates a pulp mill at Little Rapids and specialty paper mills at Gresham and Shawano, all in Wisconsin.

Of the new financing, $300,000 was obtained from the Prudential Insurance Co. of America as an unsecured 11-year loan. The other $200,000 was obtained from the First National Bank of Chicago.

Mr. Egan said the money would be used to refund existing debt, increase working capital for expansion and to provide capital improvements for greater capacity and efficiency. The company is currently installing an additional new steam turbine power plant at the Shawano mill.

Crossett Co. to Expand Lab

Crossett Co. will spend $200,000 in 1958 to enlarge its research laboratory. Some 5,500 square feet of floor space will be added to the laboratory at Crossett, Ark., a 60 per cent boost.

The new facilities will include cold storage and constant humidity rooms and a pilot plant to test new types of bleached food board and treated paper.

CZ to Fight St. Helens Case

Crown Zellerbach Corp. will ask the United States Court of Appeals to review the decision of the Federal Trade Commission that CZ must divest itself of its St. Helens interests, company president A. B. Layton announced.

The Federal Trade Commission on January 3 ruled that Crown Zellerbach Corp. had violated the antimerger law, and ordered it to divest itself of St. Helens Pulp & Paper Co., which it acquired in 1953.

The order requires Crown Zellerbach to submit within 60 days a plan for compliance with the order, specifying the time in which it can reasonably carry out the divestiture. The Commission would then fix the date by which compliance must be effected. Meanwhile, the order prohibits the company from cutting or removing any timber on lands acquired from St. Helens (or lands on which that company had cutting rights) or selling or distributing any timber obtained from these lands.

The company will seek a reversal of the Commission's order. Mr. Layton stated that, before the acquisition of St. Helens, CZ was advised by counsel that the acquisition was in accord with the antitrust laws and that the company is confident that its legality will be established in the courts.

The Commission's decision was based upon Section 7 of the Clayton Act as amended in 1950, and the application of the Act to the complicated issues involved in the St. Helens case will require further interpretation by the courts.

Paper Sleeping Bag for Forestry Service

Want to go to sleep in paper?

You can with a paper and cloth sleeping bag developed for the U. S. Forestry Service that's now available to individuals. It's ability to keep you snug and warm while camping out has been tested by fire fighters in the far west who make those hair-breadth parachute jumps to put out forest fires. It's big enough to take care of a hefty six-footer and strong enough to keep him in the bag if he turns and tosses.

The original idea for the "Sleep-Sak" stemmed from a need of the Forestry Service for a lightweight, disposable sleeping bag. It had to be light to go with the parafighters. Every ounce of weight counted. Yet it had to be sturdy enough for several nights sleeping out in rugged terrain without splitting or tearing. The all-important point of keeping the sleeper warm had to be considered.

Another practical consideration was in keeping supply depots serviced with quantities for any emergency. There was also the difficulty of returning regular sleeping bags to these depots, through almost inaccessible areas.

Answering these requirements is the sleeping bag as made by the National Fiber and Cushioning Co., Rockingham, N. C., using a specially processed kraft paper called Corrucrepe produced by Cincinnati Industries, Inc., Cincinnati, Ohio.

The Corrucrepe is kraft paper that's been creped and corrugated so it stretches in all directions. It's widely used in industry for packaging, cushioning, as a liner, wrapper for small parts and to make tarpaulins and drop cloths. In the sleeping bag, it is wax treated for water repellency.

Since the tough paper has the ability to be sewn like cloth, a "sandwich" is made. There's a layer of Corrucrepe, a layer of lightweight insulating paper and another piece of Corrucrepe. The corrugations also have insulating value. The pieces are made in a long length, then folded over and stitched along the sides. A cloth neckpiece and a heavy duty paper for a headrest are added to the top and there's the sleeping bag. By folding the "sandwich," there's no stitching in the foot area, preventing your big toe from making a hole. You sleep warmly between the top and bottom "sandwiches."

Inquiries regarding uses of Corrucrepe should be directed to Cincinnati Industries, Inc., Lockland, Cincinnati 15, Ohio.

Wheelwright Mill Increases Operations

Romar Tissue Mills, operating the former Doeskin Co. plant in Wheelwright, Mass., in late December started up another paper machine, making a total of three put into operation there since last July when production was commenced.

The mill was bought last summer by a local group headed by Robert Belsky of Holyoke.

Newsprint '58 Capacity Double '46 Consumption

The Newsprint Information Committee predicted this week that North American newsprint production capacity, which achieved a record level in 1957, will set new records in each of the two years ahead. The committee of representative Canadian producers gives these perspectives in the forthcoming January issue of its publication, Newsprint Facts:

1—The North American newsprint industry pushed its rated capacity past the 8,000,000-ton mark for the first time in 1957 as its expansion program hit full stride. This is twice as much as the continent's mills produced in 1939.

2—Before 1958 is over, start-up of more new or modernized facilities will bring rated capacity above 9,000,000 tons, twice as much newsprint as the North American market absorbed in 1946.

3—In 1959, as additional machines come into production and modernization continues, there will be capacity for close to 10,000,000 tons, nearly 40 per cent more newsprint than was used in the United States and Canada in 1955, a year of short supply.

Actual absorption of newsprint by U. S. publishers in 1957 was virtually the same as in 1956 despite the extensive new facilities. Thus, for the first time in 11 years the industry's operating ratio fell below 100 per cent of rated capacity.

Paper and Board Production

According to the American Paper and Pulp Assn., the ratio of the United States production to mill capacity for the week ending December 28, 1957, was 51.2 per cent compared with 92.0 per cent revised for the preceding week. The ratio was 66.7 per cent for the corresponding week a year ago. Mills producing newsprint exclusively are not included.

The paperboard production ratio for the week ending December 24, 1957, was 93 per cent compared with 92 per cent for the preceding week and 96 per cent for the corresponding week last year. The paperboard production ratio for the week ending December 28, 1957 is not yet available; the ratio for the week ending December 29, 1956 was 52 per cent.

The sharp decline in operating ratio is due to the Christmas holiday.

(Detailed statistics on page 52.)

Subject of Bolton Contest Announced

The Superintendents Association and John W. Bolton & Sons Inc. join in announcing the essay subject for entries in the 11th annual Bolton Award contest. Subject is "How I Can Help Relations Between My Company and My Community."

As in previous Bolton Awards 10 national cash prizes consisting of $1000, $750, and $500 and seven prizes of $200 are awarded. Winning papers are selected on the basis of the ideas contained, their value, interest and originality rather than on writing skill.

The Bolton Award contest is open to all employees of pulp and paper mills in North America. The contest period begins January 1 and ends midnight, March 31, 1958. Essays should be approximately 1500 words or less, typed with double spacing on one side of standard 8½ x 11 inch plain paper. First page only should have name, position or duties, mill, and both mill and home addresses.

Entries are to be postmarked before midnight March 31, 1958, addressed to the Secretary and Treasurer, The American Pulp and Paper Mill Superintendents Assn., 327 So. LaSalle Street, Chicago 4, Ill.

Winners will be announced in June.

PEOPLE

Norman F. Greenway

Continental Can Appoints Greenway Executive VP

Norman F. Greenway has been appointed executive vice president of the Robert Gair Paper Products Group of Continental Can Co. He was formerly vice president and general manager of Continental's Boxboard and Folding Carton Division.

George E. Dyke, vice chairman of the board, who has been serving as acting executive vice president of the Gair Group, has reached the regular retirement age for officers and will retire December 31. He will continue as a director and will serve as a consultant to the management.

Mr. Greenway was a senior vice president and director of the Robert Gair Co. before it merged with Continental in 1956. He joined Gair in 1934 and became a vice president in 1939.

Amer. Pad & Paper Names New VP

Richard M. Weiser Jr. has been named vice president of American Pad & Paper Co. by the firm's directors.

Mr. Weiser has been connected with the Pad & Paper Co. for the past seven years as plant engineer.

Officials renamed included Philip M. Judd, president; John J. Whalen and Harland S. Bradford, both vice presidents; Donald R. Taber, treasurer; Clayton Person, assistant treasurer, and George Whitmore, clerk.

Mayor Paul L. Brougham of Holyoke, Mass. officiated at brief dedication ceremonies for the firm's new $700,000 plant on December 31.

Smith Elected President of Manning

Arlie G. Smith has been elected president, treasurer and general manager of John A. Manning Paper Co. Inc., Troy, N. Y.

He succeeds James F. Adams, who becomes chairman of the board. Albert S. Loring, vice president, becomes vice president of the board and consultant to the president. Roland Eustace succeeds him as first vice president.

Robert J. Hayes, general sales manager, has been elected vice president sales, Charles E. Lanyon, research director, becomes vice president research.

Others elected are: secretary, William H. Manning; assistant treasurer, Kenneth B. Harrington, and assistant secretary, Gladys G. Hayes.

Promotions at Champion

Kenneth Moser and Corliss Drake recently were promoted at Champion Paper and Fibre Co., Hamilton, Ohio. Mr. Moser has been named assistant superintendent of the cast coat section, and Mr. Drake has been promoted to foreman in the cast coat section.

Mr. Moser came to Champion in 1936 and was employed in the CM Trimming Department.

In 1938 he transferred to the Research Department and began working on the drum coaters. He advanced gradually and was named foreman in 1940.

Mr. Drake joined Champion in 1938 as a trucker in the roll storage department. Then in 1941 he transferred to the drum coaters and gradually worked his way up to assistant shift foreman.

Federal Paper Board Officers Retire

Howard T. Brown, chairman of the Federal Paper Board Co., retired at the end of 1957 after 41 years of service. He will continue as a director of the company.

John W. Cox, executive vice president of Federal, also retired effective December 31.

Adams Promoted

Kramer A. Adams has been assigned Oregon public information representative for Weyerhaeuser Timber Co.

Southern Calif. Mill Men Elections

Richard A. McDonald Jr., Paper Products Inc., Long Beach, Calif. was chosen president of the Paper Mill Men's Club of Southern California at an election of new officers for 1958.

Other officers elected were, vice president, C. A. Meginniss, Star Paper Co., Port Hueneme; secretary, Harry W. Granger, Oregon Pulp & Paper Co., and treasurer, Jack Courtney, Crown Zellerbach Corp.

Asa L. Murray, Oregon Pulp & Paper Co., outgoing president, was presented with an engraved radio by the members in appreciation for the work he had done during the previous year.

Cassius M. Bryan

Retires at Strathmore As Board Head

Cassius M. Bryan, chairman of the board of the Strathmore Paper Co. since 1951, has announced his retirement after more than 56 years of employment with the paper manufacturing company. He will continue as a director.

Mr. Bryan joined Strathmore in 1901, and his career has been largely concerned with the company's manufacturing activities. His long service has extended from his first job in the repair department through positions in the shipping department, and then successively as order clerk, finishing room foreman, superintendent in each of the company's mills at West Springfield and Woronoco. He has been a Strathmore director since 1925, and was vice president in charge of production from 1933 until 1951. On the death of George Williamson in 1951 he was elected chairman of the board.

Mr. Bryan will remain president of Premoid Corp., a wholly owned Strathmore subsidiary which makes imitation leather products.

Wilmer F. Kallock

Kallock Heads Ludlow Ware Plant

Wilmer F. Kallock, formerly plant manager of the Marvellum Co., Holyoke, Mass., has been promoted from the post of production quality control manager for the manufacturing plants of the Ludlow Papers Inc., in Ludlow to manager of the Ware plant.

Mr. Kallock was assistant superintendent and superintendent of the McLaurin-Jones plant in Ware, which was taken over by Ludlow Papers Inc., for 15 years. He was later employed at Eastman Kodak plant, Rochester, N. Y., before becoming plant manager at the Marvellum Co.

Allied Employee Retires After 44 Years

Charles Litten, who has seen 44 years of service with the Allied Paper Corp. and its predecessor companies in Kalamazoo, Mich. has retired as superintendent of the Monarch Book Mill.

Mr. Litten has held the supervisor's post since 1953. He joined the Bardeen Paper Co. at Otsego at the age of 16 in 1913. Since then, he has been employed by the Bardeen, King and Monarch Division of Allied.

Bagpak Assigns Eastern Manager

Joseph A. Groden has been named eastern regional sales manager of International Paper Co.'s Bagpak Division. He will supervise sales of International Paper's multiwall shipping sack division in a 14-state area along the eastern seaboard from Maine to North Carolina.

Mr. Groden, who formerly represented the Bagpak Division in the Boston area, has been associated with International Paper since 1940. He succeeds the late Lee Turner, who died December 23, 1957 at Baltimore, Md., following an operation.

Eastern Names De Zemler As Sales Manager

Charles De Zemler Jr. has been appointed Sales Manager of Eastern Corp., Bangor, Maine.

He entered the paper industry in 1935 with Brightwater Paper Co., Adams, Mass. After three years of training in Brightwater's paper mill he was transferred to sales positions in New York City and in the Midwest. After four years of service in World War II he returned to Brightwater's Cleveland office. In 1947 he became assistant sales manager of Reinhold-Gould Inc., New York distributors of fine and book papers.

In 1953 Mr. De Zemler joined Eastern Corporation as assistant district sales manager in the Chicago territory. As sales manager he will make his headquarters in the company's New York office in the Lincoln Building, 60 East 42nd St.

New Managers for Single Service Div.

Two new resident managers have been appointed by the Single Service Division of International Paper Co. The division manufactures Pura-Pak paper milk containers for the dairy industry.

Noble D. Smithson, Jr., has been named resident manager at the division's Atlanta, Ga., plant replacing Edwin R. Williams, resigned. Charles J. Waldrop has been designated resident manager of the new plant which the Single Service Division will build in North Miami Beach, Fla.

K-C Transfers

Walter A. Steiner and Sterns B. Lott have been transferred to the Kimberly-Clark Corp. plant in Niagara Falls, N. Y. Mr. Steiner will serve as superintendent of service operations and Mr. Lott as mill industrial engineer.

To Handle Gilman Board Sales

Gilman Paper Co., announces that Homer Lake, assistant to the vice president in charge of sales for the past 10 years, has retired, and has moved to Montana. His duties in connection with the sale of bleached kraft board are now in the hands of Leo Morgan, who will report to H. C. Lawless, vp and director of sales for all Gilman products. Mr. Morgan came to Gilman from Clifton Paper Board Co., where he was sales representative for paper board and boxboard. Previously he was export sales manager for all products of Container Corp. of America.

Champion Named Night Supt.

Lester E. Hightower has been named night superintendent of the coating department at Champion Paper and Fibre Co., Hamilton, Ohio.

His Champion career began in 1935 as a reel trucker in the coating department. He transferred to the scales in 1938 and then moved to the drum coat department in 1939. In 1941 he was promoted to foreman on the drum coaters. Then in 1954 he advanced to assistant supervisor of cast coat, the position he held prior to his recent promotion.

Container Expert Joins La Boiteaux

LaBoiteaux Co., Cincinnati, Ohio paperboard distributors, has appointed Louis S. Treen as sales representative and container consultant.

Mr. Treen was formerly with Owens-Illinois Glass Co., and served in various supervisory capacities of their shipping container operations prior to joining LaBoiteaux.

Waxed Paper Group Selects Committee

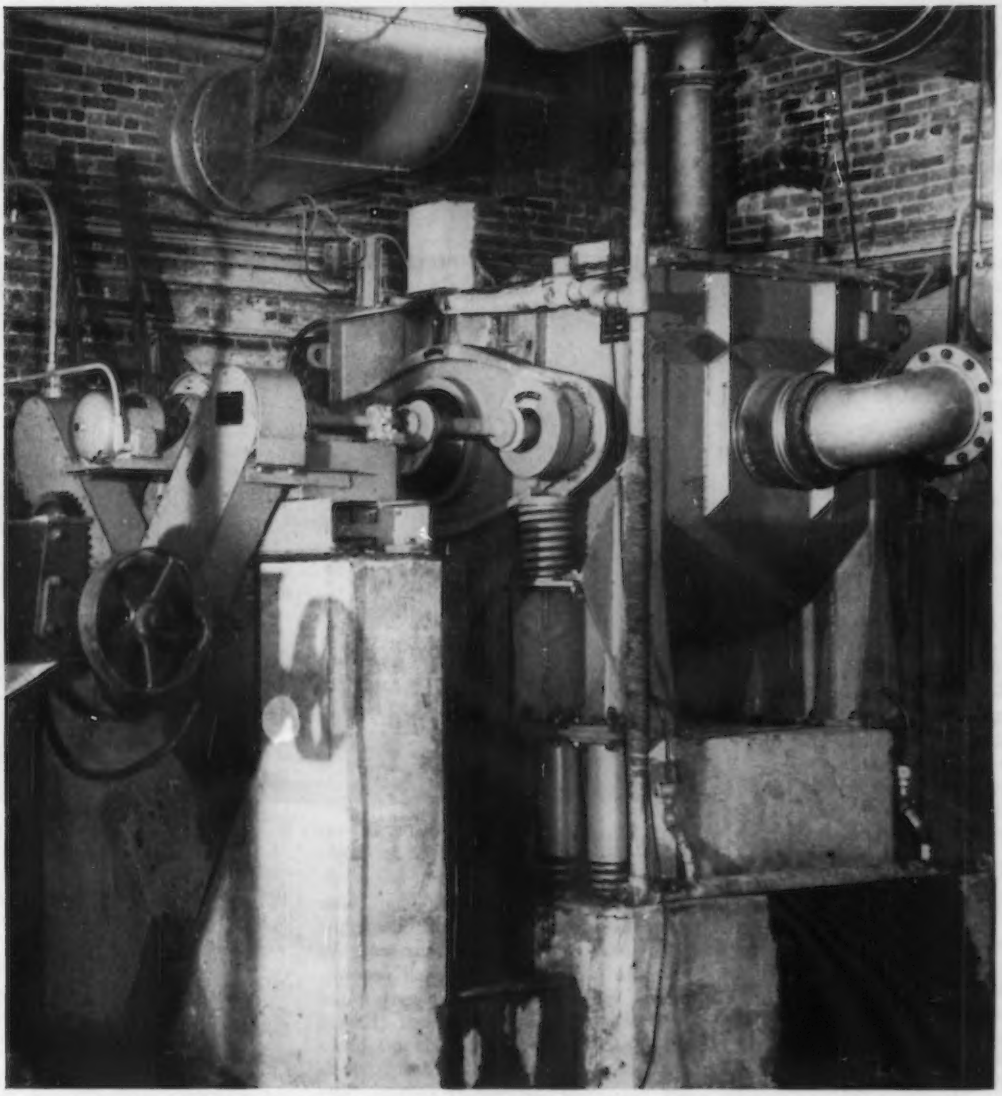
Robert Vandenberg, director of research for Marathon Corp., has been elected chairman of the Joint Technical Committee of the Waxed Paper Merchandising Council and the Waxed Paper Institute.

Other committee members for 1958, all heads of the technical research and development departments of their companies, include Harlan Anderson, Rapinwax; Robert Dale, Nashua Corp.; C. J. Johnson, Pollack Paper Corp.; Morris Kane, Kalamazoo Vegetable Parchment Co.; Myron H. Kollen, Fabricon Products; Carl Olstad, Western-Waxide Division of Crown Zellerbach Corp.; Warren Price, Central Waxed Paper Co.; and Paul Wolper, Riegel Paper Co.

In addition, Dr. J. S. Barton, director of packaging research and development for Western-Waxide, Harold Brady, technical director of Dixie Wax Paper Co., and Hunter Phillips, technical director of Bryce Packaging Co., serve as auxiliary members of the Technical Committee.

Hammermill Traffic Manager Retires

Parke W. Herrick, traffic manager of Hammermill Paper Co., Erie, Pa., for the past 20 years, retired January 1 upon completing 40 years of service. He is succeeded by Raymond H. Hain, assistant traffic manager since 1944.



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In the installation shown above, one Bird Vibrotor Screen replaced six screens and their pumping equipment.

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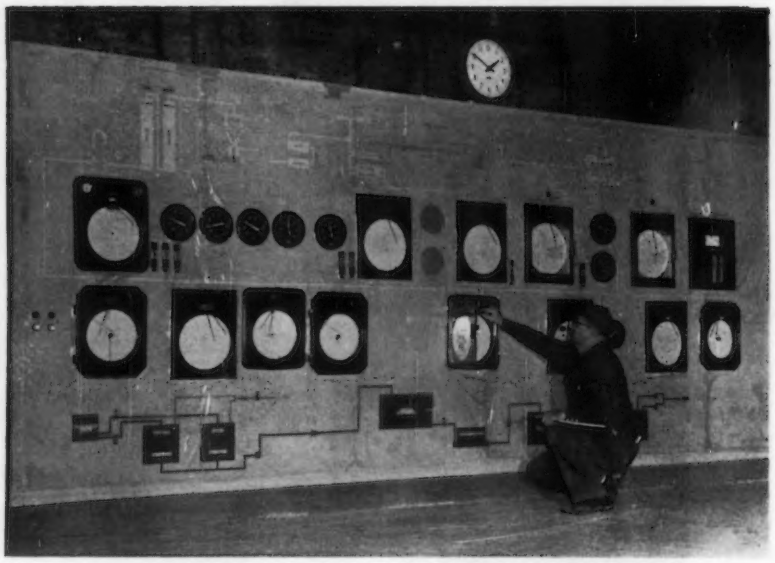
Canadian Manufacturers of Bird Machinery
CANADIAN INGERSOLL-RAND COMPANY, Limited, Montreal

New Semi-Automatic Bleach Liquor System at Mechanicville

Gilbert C. Dehnkamp
Technical Service Supervisor
West Virginia Pulp & Paper Co.
Mechanicville, N. Y.



The decision to raze the idle soda pulp mill at the Mechanicville mill of the West Virginia Pulp and Paper Co. brought about the replacement of calcium hypochlorite by sodium hypochlorite as mill bleach.

For many years, a slurry of slaked lime prepared and stored in tanks in the soda mill was used as the base for bleachmaking. Although lime base bleach was satisfactory for bleaching both the sulphite and semichemical pulps made at Mechanicville, cost studies indicated that replacement of the lime slaking equipment would be more expensive than changing to soda base.

Now sodium base hypochlorite with a very uniform strength of about 30 grams of available chlorine per liter is made at the Mechanicville mill in a semi-automatic system requiring only part-time attention by an operator. Instruments are used to control preparation of the dilute caustic soda used as a raw material, to monitor and control the bleachmaking reaction, and to measure the bleach flow to the pulp mill bleachery. These instruments have made possible the production of sodium hypochlorite bleach of practically constant composition throughout the year. In addition, the instruments can automatically adjust the system to cope with unusual chlorine flows without exposing personnel to risk.

Caustic Soda Available

At West Virginia's Mechanicville mill, we had sufficient by-product caustic soda available from our caustic-chlorine plant to meet bleach requirements. We had long used an evaporator to concentrate liquor from our Hooker cells, producing caustic soda of 40 to 50 per cent concentration from which the unreacted salt was recovered. Surplus caustic soda beyond that required in the pulp mills for cooking liquor preparation and bleaching was sold.

Another important factor in our decision to change to soda base was the availability of a suitable instrument, the Foxboro EMF Dynalog oxidation-reduction potential recorder-controller, to monitor and control the bleachmaking process. Electrodes of this instrument could be immersed in flowing sodium hypochlorite for long periods of time without noticeable surface scale formation such as would occur in calcium hypochlorite. We considered instrumental control desirable because bleach of uniform strength could be produced with little operator attention.

Bleachmaking Process

At Mechanicville, we make sodium hypochlorite by reacting chlorine gas from Hooker cells with caustic soda solution in an absorption chamber. A slight excess of caustic beyond that required to react with chlorine according to the reaction stabilizes the hypochlorite against decomposition and also serves as a portion of the alkaline buffer needed in the last stage of pulp bleaching.

$$2\ NaOH + Cl_2 \rightarrow NaOCl + NaCl + H_2O$$

When caustic soda of constant known strength is used as a starting material, the excess caustic in the product can be measured with an oxidation-reduction potential recorder, thus giving an indirect measure of the hypochlorite strength. In the usual application, the controller is used to regulate chlorine flow in such a way that the concentration of excess caustic remains constant. At West Virginia's Mechanicville mill, however, chlorine flow cannot be regulated closely. In addition to the chlorine gas directly channeled to bleachmaking, vent gases or "sniff gases" from chlorine liquefaction and chlorine storage tanks are also sent to the absorption chamber. Because the chlorine flow at any time is indeterminate, the controller regulates the input of caustic soda to the absorption chamber to maintain desired excess caustic in the product.

Instrumentation

Instruments used at Mechanicville to

control bleachmaking are mounted on the panel board illustrated in Figure 1. Chlorine, caustic soda, and bleach flows are shown schematically on this panel board, which is located near the chlorine liquefaction area several yards from the actual bleachmaking process. The liquefaction operator can look at instruments and recorders on the panel board to determine whether the bleachmaking process is operating satisfactorily. He can also make necessary process corrections by adjusting the controllers on the panel board.

The principal instrument used is the Foxboro oxidation-reduction potential recorder-controller. The sensing electrodes of this instrument are immersed in the stream of freshly made sodium hypochlorite as it flows from the absorption chamber. When the potential across the electrodes differs from the desired level set on the controller, a signal from the controller regulates the flow of caustic soda to the absorber in such a way that the potential is made to approach the desired level. If the potential is less than desired, the caustic flow is decreased; if the potential is more than desired, the caustic flow is increased. Response of the controller to changes in potential is rapid. Only a few minutes are needed to restore equilibrium after a change.

A Minneapolis-Honeywell multipoint temperature indicator enables the operator to determine temperature at several critical points in the system. Knowledge of temperature is important to us because undesirable side reactions, such as the formation of chlorates, occur when temperature is allowed to exceed certain levels. These side reactions consume chlorine but do not yield bleach.

We meter water to the caustic dilution tank through a Niagara water meter placed in the input water line several feet from the panel board. This meter enables the operator to make up a fresh batch of approximately 4 per cent caustic soda from 13½ per cent caustic soda with very little attention. To add the desired volume of water to the dilution tank, the operator sets the meter to the volume and pushes the start button. When the volume has been delivered, the meter automatically shuts off the water flow.

A level recorder-controller with a sensing unit in the 13½ per cent caustic tank controls the addition of this caustic to the dilution tank. The operator checks a laboratory report to find the actual concentration of the previously prepared nominal 13½ per cent caustic. From a calibration chart he determines the decrease in level equivalent to one batch of approximately 4 per cent caustic. He then moves the set point on the level controller down to the required level and pushes a switch button to start caustic flow to the dilution tank. When the actual level falls to the set point, caustic flow stops automatically. Compressed air injected into the tanks mixes the dilute caustic soda thoroughly.

Bleach flow to the pulp mill bleachery is measured by a Minneapolis-Honeywell flow recorder. This recorder permits a check on the volume of bleach produced.

Other instruments mounted on the panel board include several level and pressure indicators and recorders.

Soda Base Bleach Advantages

At our Mechanicville mill, soda base bleach liquor has several advantages over lime base bleach. Lime handling and slurry preparation and storage are not required. Instead, by-product caustic soda from our chlorine plant is used. Little operator attention is required. No sludge settles from soda base bleach. Tanks and pipes no longer require frequent cleaning. Pollution of the river by calcium chloride sludge is eliminated, as is the loss of bleach which cannot be effectively separated from the sludge. Soda bleach does not cause scaling on rotameters used to measure bleach addition in the pulp bleachery. Strength of the bleach, measured as available chlorine, can be more closely controlled because the instruments correct variations from desired strength rapidly. This closely controlled strength enables more efficient use of bleach in the pulp bleachery.

On the other hand, soda base bleach has a few disadvantages. It is more corrosive than lime bleach, but we have not noticed any severe increase in corrosion of our tanks and pipes. Temperature control is critical. Soda base bleach of the concentration used at Mechanicville is unstable at temperatures above 95°F. During the summer months when river water temperature is high, the mill supply of water is too warm to use for bleachmaking. An effective remedy available to us at Mechanicville is the use for bleachmaking of water from the municipal supply which is several degrees cooler than the mill supply.

Summary

During several months' experience, our instrument controlled bleachmaking system has operated very satisfactorily. Kenneth W. Timmerman, our chlorine plant superintendent, estimates that the cost of our soda base bleach is very nearly the same as that of the lime base bleach formerly made. Quality of the soda base bleach is much more uniform. Little maintenance has been required. We no longer need a full-time bleach operator; the chlorine liquefaction operator can easily oversee bleachmaking from the instrument panel board. As an extra dividend, objectionable pollution of the Hudson River by calcium chloride sludge has been eliminated.

"I don't care if you are safety supervisor at the mill . . . I'll look after any campaigns around here!"

Westinghouse Life-Line A motors helped save $13,500 in olive pitting operation...

at Bell Packing Corporation Berkeley, California

Continuously driving brine pumps for olive-pitting operation, Westinghouse motors have helped cut production cost, improve product quality

"Westinghouse Life-Line 'A'® motors make possible the profitable functioning of the new pitting room in our olive canning plant," states Mr. William Carlson, Plant Superintendent at Bell Packing Corporation, Berkeley, California.

Mechanizing this operation has increased production 15% and released a good share of the normally required manpower for use elsewhere in the plant. In three years, Bell Packing reports a saving of $13,500. In designing the area, Bell Packing Corporation considered the choice of motors for the brine pumps the most serious problem. Westinghouse 1 hp, Life-Line "A" motors were chosen on their record of long-term, trouble-free life under the toughest conditions.

POWER-UP with the motor designed to meet modern industry's needs. For complete information, call your Westinghouse sales engineer, or distributor. Or, write Westinghouse Electric Corporation, P.O. Box 868, 3 Gateway Center, Pittsburgh 30, Pennsylvania. J-22058

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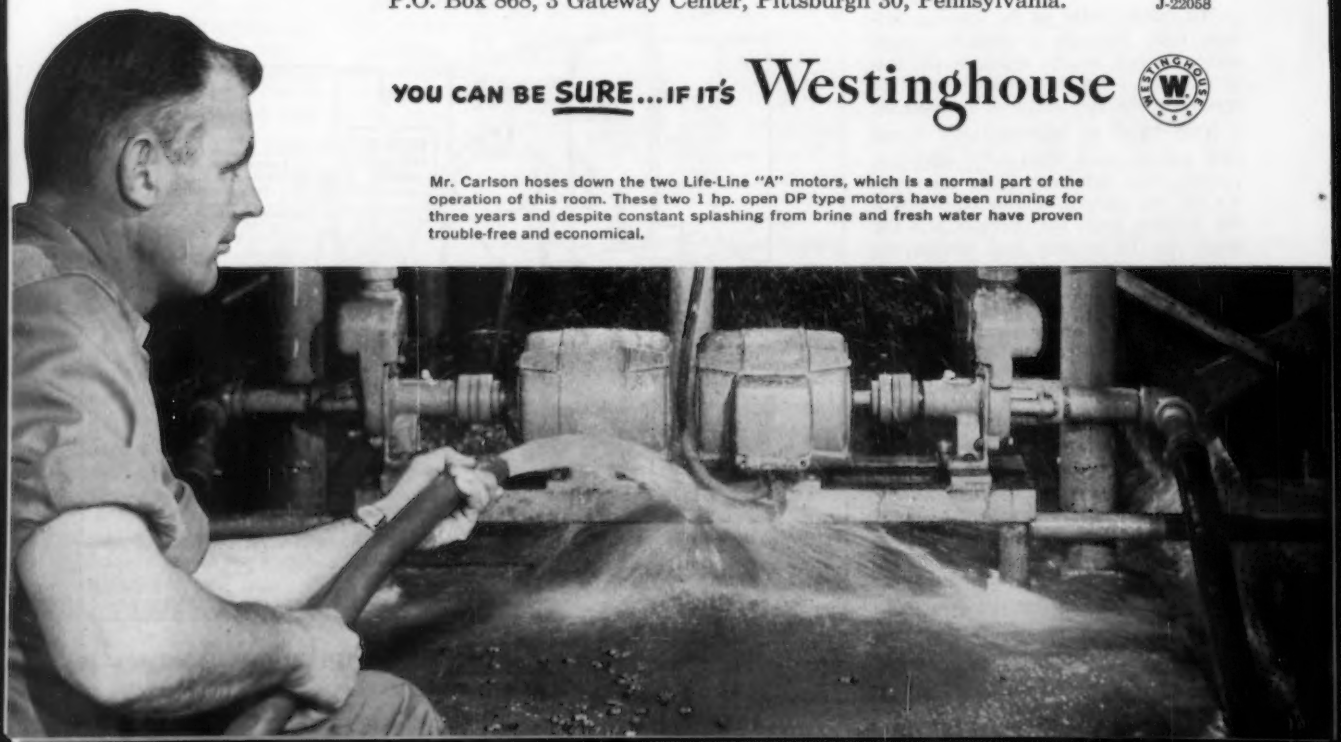
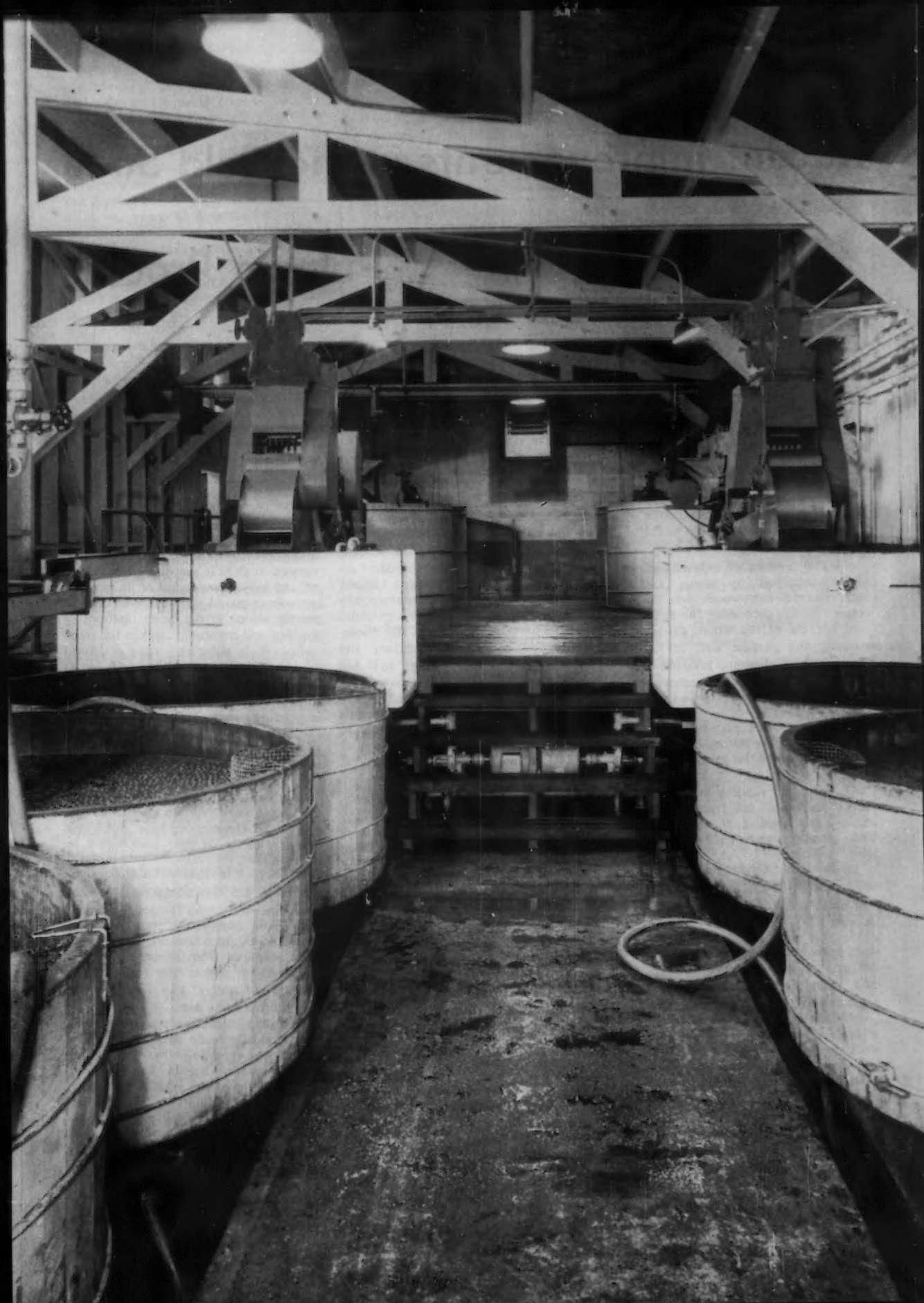


Mr. Carlson hoses down the two Life-Line "A" motors, which is a normal part of the operation of this room. These two 1 hp. open DP type motors have been running for three years and despite constant splashing from brine and fresh water have proven trouble-free and economical.



Recent Improvements in the Cold Soda Pulping Process

Summary

The cold soda process, a high-yield semichemical-type pulping method developed at the Forest Products Laboratory, was applied to several hardwoods to determine the effect of certain variables on liquor penetration, pulp opacity, and color.

The primary results were as follows:

(1) The amount of caustic soda liquor absorbed by aspen and southern red oak woods was increased by (a) decreasing the moisture content of the wood, (b) decreasing the particle size, (c) increasing the hydrostatic pressure in the treating vessel, or (d) removing the air from the wood prior to treatment.

(2) For a given yield, an increase in the temperature during cold soda pulping decreased the opacity of the bleached pulp.

(3) Increased refining in disk refiners decreased the freeness, increased the amount of fine fibers, and increased the opacity of the pulp.

(4) Increased brightening of cold soda pulp with calcium hypochlorite decreased its opacity at a given density.

(5) Wet pressing bleached cold soda pulps with increasing amounts of pressure increased their density and strength but decreased both their opacity and brightness.

(6) Screw pressing aspen chips after they were treated with caustic soda and before fiberizing increased the pulp brightness about 5 percentage points and appeared to remove some of its characteristic yellow color.

(7) The addition of anionic and nonionic surfactants to the caustic soda treating liquor slightly increased the strength, and in some cases the brightness, of cold soda pulps made from southern red oak.

Kenton J. Brown

Chemical Engineer, Forest Products Laboratory
Forest Service, U. S. Department of Agriculture
Madison, Wisconsin

There has been much evidence during recent months of increasing interest by the pulp and paper industry in the cold soda pulping process. The process, a semichemical-type pulping method developed at the Forest Products Laboratory, is now being used commercially in the United States to produce pulps from hardwoods for use in the manufacture of corrugating medium and printing papers. A European mill has begun to make toilet tissue from cold soda pulp. Other types of paper and board products may also find use for this pulp, as further research promises to develop the process in the direction of greater versatility and more economical processing.

Basically, cold soda pulping consists of treating chips with a sodium hydroxide solution, draining off excess liquor, and fiberizing the softened chips in a disk mill. The process will operate satisfactorily at or slightly above room temperature. A chemical treatment of one to two hours is customary for steeps made at atmospheric pressure. The steeping time can be shortened to 30 minutes or less by applying hydrostatic pressure to the liquor surrounding the chips in the treating vessel. Possibilities for conducting the process continuously are constantly being explored. It appears from results at the Forest Products Laboratory that cold soda pulps of good quality can be made by applying the caustic soda solution at the same time the chips are being broken down in a refining-type mill(*1*). In this case the distribution of the chemical to individual fibers is accomplished in a matter of seconds, and the advantages of continuous operation, uniformity and better quality control are realized. An important feature of this particular continuous method is that there is no drain off and subsequent re-use of liquors that are contaminated with dissolved organic matter, which in the batch methods of treating will eventually darken the pulp.

Cold soda pulps that were produced from hardwoods at yields of about 92 per cent are being used as partial substitutes for softwood groundwood pulps in printing papers. Using hardwoods for this purpose appears to be one of the more promising means of meeting the future fiber requirements of the industry. Before this can be done more extensively, however, certain quality problems must be solved. On the credit side, cold soda groundwood-type pulps are usually slightly stronger and higher in freeness than the softwood groundwood pulps they are to replace (Table I). However, they are also denser and contain fewer fine fibers, two factors that make them more transparent than softwood groundwood. Furthermore, cold soda pulps prepared from dense hardwoods are somewhat darker than conventional groundwood pulps and have to be bleached for some uses.

Cold soda pulps for corrugating board are necessarily made stronger than the groundwood-type pulps by using larger amounts of caustic soda. The optimum yield for pulp of this quality is usually 87 per cent. Amounts of material required to produce pulps from certain representative hardwoods by this process (and bleach them in the case of groundwood substitutes) are listed in Table II.

The cold soda process appears to be the least expensive of the chemical or

Presented at the Sixth Annual Pulp and Paper Conference held at the College of Engineering, University of Florida, Gainesville, Fla., December 2, 1957.

semichemical processes now available. Examples of estimated costs of making cold soda and groundwood pulps are given in Table III. In comparison to softwood groundwood pulp, the extra cost for chemicals used in producing hardwood cold soda pulp in the northern United States would be more than offset by savings in wood and fiberizing energy costs. Energy required to fiberize cold soda pulps made from southern oaks and gums is about one half of that used to grind southern pines, but in this case the pulpwood costs are about the same. The total cost of manufacturing pulp by these two methods in the southern United States would be nearly the same if the cold soda pulp could be used unbleached.

Operating costs in the cold soda process could be lowered if shorter treating periods and more efficient use of the chemical could be accomplished. This means using improved methods to disperse minimum amounts of caustic soda quickly and uniformly to all of the fibers in the chip. Some factors to consider in experimentation on this problem of liquor distribution are the effects of using forced penetration mechanisms, air removal procedures, and chemical additives in applying the caustic soda solution. The size and moisture content of the chips are also important factors. One of the purposes of this report is to review the results of some of the recent research made on penetration of caustic soda liquor at the Forest Products Laboratory and discuss their significance in connection with improving the process.

Other pulping studies reported here were concerned with improving the optical properties of cold soda pulps. In addition to lacking opacity and being darker in color than groundwood pulps they have a yellow color that persists even after bleaching by conventional single-stage methods. These experiments were designed primarily to obtain an understanding of the optical characteristics of cold soda pulps so that future research can be directed at the sources of the problems.

Experimental

Tests were made on southern red oak and eight other hardwoods. The other hardwoods, representative of the forests

TABLE I—TYPICAL PHYSICAL PROPERTIES OF UNBLEACHED COLD SODA AND GROUNDWOOD PULPS USED IN PRINTING PAPER PRODUCTION

Species	Freeness (Canadian Standard)	Bursting strength	Tearing resistance	Breaking length	Density	Brightness (G.E. equivalent)	Fiber fraction passing a 200-mesh screen
	Ml.	Pts. per lb. per rm.[1]	Gm. per lb. per rm.[1]	Meters	Gm. per cc.	Per Cent	Per Cent
COLD SODA GROUNDWOOD TYPE							
Southern red oak ...	130	0.30	0.70	3,200	0.50	41	33
North-central mixture[2]	140	.34	.70	3,800	.53	43	30
GROUNDWOOD							
Southern pine	70	.22	.59	2,100	.36	56	45
Spruce	70	.32	.60	3,200	.46	60	45

[1] Ream of 500 sheets, 25 by 40 inches.
[2] Chip mixture consisted, by weight, of 50 percent of soft maple and 10 percent each of red oak, white oak, elm, ash, and yellow birch.

TABLE II—COLD SODA PULP MANUFACTURING FACTORS

Hardwood	Materials and power required per ton of air-dry pulp: Cold soda pulp yield	Pulpwood[1]	Caustic soda	Fiberizing energy	Bleaching Chemicals[2]: Lime	Bleaching Chemicals[2]: Chlorine
	Per Cent	Cords	Lb.	H.p.-days	Lb.	Lb.
MAGAZINE BOOK-TYPE PAPERS						
Southern red oak	92	0.7	175	44	108	90
North-central mixture[3]	92	.8	165	40	108	90
Aspen	92	1.2	155	39	86	72
NEWS-TYPE PAPERS						
Southern red oak	93	.7	155	40	86	72
Aspen	93	1.2	135	36	48	40
CORRUGATING BOARD						
Southern red oak	86	.8	255	25	—	—
Aspen	87	1.3	230	20	—	—

[1] Based on 83 cubic feet of solid wood for standard cord of unbarked logs.
[2] Required to prepare calcium hypochlorite and to bleach the pulp in a single-stage procedure. Small amounts of sodium silicate and caustic soda are also needed to control the pH.
[3] Average values for a mixture, by weight, of 50 per cent of soft maple and 10 per cent each of red oak, white oak, elm, ash, and yellow birch.

TABLE III—EXAMPLES OF ESTIMATED COST FACTORS FOR MANUFACTURING COLD SODA AND GROUNDWOOD PULPS FOR USE IN PRINTING PAPERS

Process	Species	Pulpwood: Cost per unbarked cord	Pulpwood: Required per ton of air-dry pulp[1]	Cost per ton of air-dry pulp (in slush form): Wood	Caustic soda (at 3.5c per lb.)	Energy[2] for chipping and fiberizing or grinding	Pulping labor ($2 per hr.)	Bleaching chemical labor, and steam	Water (at 5c per 1,000 gal.)	Total (excluding depreciation and overhead)
		Dollars	Cords	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars
BOOK PAPER (NORTHERN SPECIES)										
Cold soda	Birch, maple, oak, elm, ash, aspen	18	0.9	16.20	4.90	5.35	6.00	20.00	0.75	53.10
Groundwood	Spruce (local)	30	1.2	30.00	None	8.50	6.00	6.00	.50	57.00
NEWSPRINT (SOUTHERN SPECIES)										
Cold soda	Oak, gum	20	.8	16.00	6.65	5.35	6.00	10.00	.75	44.75
Groundwood	Southern pine	20	.9	18.00	None	10.70	6.00	None	.50	35.20

[1] Based on 83 cubic feet of solid wood for standard cord of unbarked logs.
[2] Based on cost of 0.75 cent per kilowatt-hour.

in the northern United States, included aspen and paper birch (which were tested individually), and a mixture of soft maple, red oak, white oak, elm, ash, and yellow birch. All the pulpwood was peeled and, unless otherwise stated, converted into standard-sized ⅝-inch chips for pulping experiments. Blocks used for penetration studies were cut from the heartwood of southern red oak logs.

Liquor Absorption Variables

Pressure.—These experiments were designed to study both natural penetration and forced penetration at room temperature. The blocks of southern red oak heartwood were treated with a solution of 50 grams of caustic soda per liter at atmospheric pressure and under a hydrostatic pressure of 150 pounds per square inch (gage) for periods of 0.5 and 2 hours at 25°C. Previous penetration studies made with caustic soda liquor on aspen blocks indicated that 150 pounds per square inch (gage) was the most practical pressure for hydrostatic treatment in this process*(2)*.

The blocks were cubes with sides of 0.5, 1, or 2 inches. Treatments were made on several samples at a time (usually 5) placed in a wire basket that was suspended in a stainless steel autoclave of 0.8-cubic-foot capacity. The amount of solution absorbed by the blocks was determined from the difference in weight before and after the treatment. The extent of penetration through the blocks was observed by splitting them longitudinally and dusting phenolphthalein powder on the face of the split section to clearly outline the presence of alkali.

As shown in Table IV 2-inch blocks of red oak heartwood with a moisture content of 10 per cent picked up five times more liquor in 0.5 hour at 150 pounds per square inch (gage) pressure than they did at atmospheric pressure. The blocks soaked for 2 hours at atmospheric conditions absorbed only 30 per cent as much liquor as those impregnated with hydrostatic pressure for 30 minutes. Results of tests made on blocks that contained 35 per cent moisture showed the same beneficial effects of increasing pressure but to a lesser degree (Table IV).

Vacuum.—A vacuum of 26 inches of mercury was drawn on the 2-inch blocks and held for 5 minutes before the caustic soda liquor entered the autoclave. The extent of penetration into the blocks that contained 10 per cent moisture was increased considerably by pre-evacuating the wood before steeping at atmospheric pressure. Pre-evacuation also improved results of the hydrostatic treatment but to a lesser extent. Absorption values in Table IV show that removing the air from the wood before steeping at atmospheric pressure was as effective as applying a hydrostatic pressure for 30 minutes. Recent cold soda pulping tests made on green aspen that contained 47 per cent moisture also showed benefits from pre-evacuation*(3)*.

Particle size.—Decreasing the dimensions of the red oak cubes in the range from 2 inches on a side to 0.5 inch increased the liquor absorption in a range of from 60.0 to 82.8 per cent during treatments of 30 minutes at 150 pounds per square inch (gage) (Table IV). This increased absorption was probably due only to the greater amount of surface for a given weight on the smaller blocks. The liquor penetrated through only the open structure of the wood (vessels) and left the surrounding dense fiber structure untreated to about the same extent in blocks of each size.

Cold soda pulping tests were made on predisintegrated aspen chips and compared to those made on standard full-sized chips. The small chips were prepared by passing normal chips through breaker plates in an 8-inch disk mill, and accepting the particles passing a ⅛-inch screen but held on one of 1/16-inch mesh. The average dimensions of these particles were 1/16 inch in both the radial and tangential directions and ⅝ inch in the longitudinal fiber direction. Comparisons of pulping tests made at both atmospheric pressure and hydrostatic pressure after pre-evacuation on both sizes of chips are given in Table V. After two hours of steeping at atmospheric pressure, the liquor penetration in the small particles was complete but the larger chips had dry centers. Penetration was found to be complete in both cases after the forced penetration treatments. Under both conditions of pulping the amount of liquor absorbed, and consequently consumed, was increased considerably by decreasing the chip size. The increased consumption of chemical decreased the pulp yield about 4 per cent. Preparing the small chip particles probably did some damage to fibers since the pulps prepared from them had bursting strengths about 10 per cent lower in each case (Table V).

Moisture content.—As shown in Table IV, when the moisture content of the red oak one-inch blocks was decreased from 35 to 10 per cent, the amount of liquor absorbed in 30 minutes at 150 pounds per square inch (gage) was increased about three times. The effect on cold soda pulping of a decrease in the moisture content of aspen chips from 46 to 7 per cent is shown in Table V. The drier chips absorbed 60 per cent more liquor and produced 3.5 per cent less pulp after being treated 10 minutes at 150 pounds per square inch (gage) following pre-evacuation. The difference in moisture content had no significant effect on pulp strength, which substantiates results of other experiments on green and air-dry aspen reported previously*(3)*.

Surfactants. — Standard-sized chips and one-inch cubes prepared from southern red oak were treated with caustic soda liquors containing varying concentrations of several different types of surface-active agents to determine their effects on the rate of penetration and pulping characteristics in this process. Examples of typical results are given in Tables IV and VI. Adding 10 grams

TABLE IV—EFFECT OF VACUUM, PRESSURE, SURFACTANT, PARTICLE SIZE, AND MOISTURE CONTENT ON THE ABSORPTION OF A CAUSTIC SODA SOLUTION (50 GRAMS PER LITER) AT ROOM TEMPERATURE BY CUBES OF SOUTHERN RED OAK HEARTWOOD

Cube dimensions (on each edge)	Pre-evacuation (vacuum)	Pressure drying steep (gage)	Duration of steep	Concentration of anionic	Solution absorbed (per 100 lb. of moisture-free wood)
In.	In. Hg	P.s.i.	Hr.	Gm. per l.	lb.
		MOISTURE CONTENT—10 PERCENT			
2.0	None	0	0.5	None	11.7
2.0	None	0	2.0	None	17.6
2.0	None	0	2.0	10	26.4
2.0	None	150	.5	None	60.0
1.0	None	150	.5	None	74.0
.5	None	150	.5	None	82.8
2.0	26	0	.5	None	59.3
2.0	26	150	.5	None	77.0
		MOISTURE CONTENT—35 PERCENT			
1.0	None	0	2.0	None	15.7
1.0	None	0	2.0	10	20.2
1.0	None	150	.5	None	23.5
1.0	None	150	.5	20	32.0

TABLE V—EFFECT OF CHIP SIZE AND MOISTURE CONTENT ON CHEMICAL CONSUMPTION, PULP YIELD, AND PULP STRENGTH IN THE COLD SODA PULPING OF ASPEN AT ROOM TEMPERATURE

Treatment number	Average chip dimension[1] Width	Thickness	Chip Moisture content	Caustic soda concentration	Pulping results (per 100 lb. of moisture-free wood) Solution absorbed	Caustic soda absorbed[2]	Pulp yield	Pulp properties (at a freeness of 250 ml. Canadian Standard) Bursting strength	Tearing resistance	Density
	In.	In.	Per Cent	Gm. per l	Lb.	Lb.	Lb.	Pts. per lb. per rm.[3]	Gm. per lb. per rm.[3]	Gm. per cc.
2 HOURS AT ATMOSPHERIC PRESSURE										
922	1	1/8	12	25	—	8.5	91.2	0.53	0.64	0.64
944	1/16	1/16	12	25	—	11.4	87.9	.47	.64	.63
5 MINUTES AT 150 P.S.I. (GAGE) AFTER VACUUM										
2824	1	1/8	6	49	241	11.4	91.3	.49	1.20	.62
2855	1/16	1/16	7	46	301	17.8	87.0	.44	.65	.59
10 MINUTES AT 150 P.S.I. (GAGE) AFTER VACUUM										
2817	1	1/8	7	50	283	16.9	89.2	.51	.75	.64
2800	1	1/8	46	49	176	10.9	92.4	.51	.88	.66

[1] Constant length in the fiber direction was 5/8 inch.
[2] Includes consumed caustic soda and the unused chemical left in the chips after the treatment.
[3] Ream of 500 sheets, 25 by 40 inches.

TABLE VI—EFFECT OF CERTAIN SURFACTANTS IN THE COLD SODA PULPING OF SOUTHERN RED OAK

Surfactant Type	Concentration	Pulping results (based on 100 lb. of moisture-free wood[1]) Liquor absorbed	Caustic soda absorbed[2]	Pulp Yield	Fiberizing energy	Pulp properties (150 ml. Canadian Standard freeness) Bursting strength	Tearing resistance	Breaking length	Density	Brightness (G.B. equivalent)
	Gm. per l.	Lb.	Lb.	Lb.	Per Cent	Pts. per lb. per rm.[3]	Gm. per lb. per rm[3]	M.	Gm. per cc.	Per Cent
BATCH TREATMENTS[4]										
None (control)	—	99.2	12.5	90.1	100	0.16	0.45	1,770	0.42	35.9
Nonionic	20	87.6	10.0	89.9	103	.21	.51	2,430	.40	37.9
Anionic	20	92.0	11.0	90.7	103	.22	.53	2,400	.42	35.7
CONTINUOUS TREATMENTS[5]										
None (control)	—	231	11.3	—	100	.25	.65	3,000	.46	40.2
Anionic	5	234	11.5	—	101	.33	.59	3,500	.51	42.4

[1] Wood treated contained 23 per cent moisture.
[2] Includes consumed caustic soda and the unused chemical left in the chips.
[3] Ream of 500 sheets, 25 by 40 inches.
[4] Made in a digester at 28°C. and 150 pounds per square inch (gage). The concentration of caustic soda was 50 grams per liter and the treating time was 30 minutes.
[5] Made in a roll mill at 30°C. and a production rate of 350 pounds of chips (moisture-free basis) per hour. The concentration of caustic soda was 51.5 grams per liter.

TABLE VII—EFFECT OF PRESTEAMING IN THE COLD SODA PULPING OF PAPER BIRCH

Treatment number	Presteaming conditions	Caustic soda treatment[1] Average temperature	Chemical consumed by reaction (moisture-free wood basis)	Treated chips having a density over 1.05 grams per centimeter	Pulp yield	Pulp strength properties (250 ml. Canadian Standard freeness) Bursting strength Pts. per lb. per	Tearing resistance Gm. per lb. per	Density Gm. per
		°C	Per Cent	Per Cent	Per Cent	rm.[2]	rm.[2]	cc.
2896,2913	None (control)	55	8.6	75	86.3	0.70	0.87	0.63
2891,2928	0.5 hour at 5 p.s.i. (gage)	58	9.5	100	86.3	.74	.74	.62
2903,2919	1 purge[3] at 50 p.s.i. (gage)	63	8.1	100	83.1	.58	.96	.61
2912	2 purges[3] at 25 p.s.i. (gage)	55	8.2	100	79.6	.65	.80	.61

[1] Chips were steeped for 1.5 hours at atmospheric pressure in a solution of 50 grams per liter of caustic soda.
[2] Ream of 500 sheets, 25 by 40 inches.
[3] Steam released immediately after reaching indicated pressure.

TABLE VIII—EFFECTS OF DISK MILL AND BEATER REFINING ON PHYSICAL AND OPTICAL PROPERTIES OF BLEACHED COLD SODA PULP[1]

Number of passes through disk mill	Freeness (Canadian Standard)	Fiber fraction passing a 200-mesh screen	Bursting strength	Tearing resistance	Density	Brightness (G.E. equivalent)	Opacity (37-lb. sheet[2])
	Ml.	Per Cent	Pts. per lb. per rm.[2]	Gm. per lb. per rm.[2]	Gm. per cc.	Per Cent	Per Cent
DISK MILL-REFINED COLD SODA							
1	280	23.7	0.12	0.29	0.30	67.9	80.9
2	240	26.5	.15	.38	.32	67.7	81.2
3	120	28.0	.24	.55	.38	68.3	83.0
BEATER-REFINED COLD SODA[3]							
3	65	26.0	.45	.63	.59	69.4	81.0
COMMERCIAL BLEACHED GROUNDWOOD[4]							
	70	43.4	.27	.55	.49	69.0	92.7

[1] Prepared from a mixture of six north-central hardwoods by steeping the chips for 1 hour at 150 pounds per square inch (gage) and 23°C. in a 14-cubic-foot digester with a caustic solution of 25 grams per liter concentration (treatment No. 4190).
[2] Ream of 500 sheets, 25 by 40 inches. Test sheets weighing 37 pounds per ream were pressed at 60 pounds per square inch (gage).
[3] Pulp from third pass through the disk mill was refined in a 1.5-pound test beater.
[4] Prepared from an equimixture of spruce and aspen.

per liter of an anionic surfactant to the liquor increased by about 50 per cent the amount of liquor absorbed by the air-dry blocks during two hours' atmospheric steeping (Table IV). Blocks containing 35 per cent moisture picked up only 30 per cent more liquor with the surfactant present under similar conditions.

In contrast to the above, the addition of surfactants of both anionic and nonionic types to liquors used in treating red oak chips (containing 23 per cent moisture) decreased slightly the amount of liquor absorbed (Table VI). The presence of the surfactants did not affect pulp yield nor did it change the chip softening effect (measured by the fiberizing energy) of the caustic soda liquor. The strength properties of cold soda pulps made by both the batch and continuous methods, using conditions described in Table VI, were increased slightly by the addition of surfactants. Adding 5 grams per liter of an anionic surfactant to the liquor in the continuous system increased the pulp brightness from 40.2 to 42.4 per cent. Pressing the treated chips (containing the surfactant) before the fiberizing operation increased the brightness still further to 43.7 per cent.

Results of other block tests (not tabulated here) with both anionic and nonionic surfactants showed that in each case a concentration of 10 grams per liter was more effective than either 5 or 20 grams per liter. In a cold soda pulping solution, use of 10 grams per liter of a surfactant that cost 20 cents per pound would increase the cost of a ton of cold soda pulp about $4.50.

Presteaming. — The effectiveness of using steam to replace air in chips, and thereby improve penetration in the cold soda process, was investigated. Each of the presteaming methods described in Table VII increased the rate at which caustic soda liquor penetrated into paper birch chips, but only the mildest conditions of steaming gave satisfactory pulping results. Applying steam at a pressure of 5 pounds per square inch (gage) for 30 minutes before the caustic soda treatment did not change the pulp yield, but did increase the bursting strength about 5 per cent in comparison with a treatment made at 55°C. without presteaming. Using the technique of curing the chips with steam at pressures of 25 and 50 pounds per square inch (gage) seriously decreased the pulp yield and strength (Table VII). The increased darkening of the pulp at pulping temperatures higher than normal would probably limit this method to production of pulp for such products as corrugating board.

Optical Properties

In making printing papers that contain cold soda pulp, the opacity, brightness and color of the paper depend on the careful control of conditions during the pulping, refining, bleaching, and papermaking operations. Since each step in preparing the pulp and making the paper has a number of variables, of which many are interdependent, the problem of producing paper with optimum optical properties from cold soda pulp is complex. The following discussion contains typical examples of basic information needed on the effect of the variables before the proper paths toward improvements can be chosen.

Pulping temperature.—An investigation was made to determine the effect of the treating temperature on the opacity and strength of cold soda pulps produced at the same level of yield. Chips from a mixture of six hardwoods typical of the north-central region (50 per cent, by weight, of soft maple and 10 per cent each of red oak, white oak, elm, ash, and yellow birch) were treated with varying concentrations of caustic soda at different temperatures. A caustic soda concentration of 30 grams per liter at a temperature of 25°C. produced a yield of 91.5 per cent; 17 grams per liter at 55°C. produced a pulp yield of 92.3 per cent; and 9 grams per liter at 85°C. provided a yield of 90.6 per cent. The cold soda pulps produced from these treatments were refined by circulation through an 8-inch disk mill and samples were taken at freenesses of approximately 300, 200, and 100 milliliters (Canadian Standard). Each pulp sample was bleached with calcium hypochlorite at both a 6 and 12 per cent available chlorine level. Handsheets prepared from the pulps at a weight of 37 pounds per ream (500 sheets, 25 by 40 inches) were tested for opacity, brightness, and strength. Screen fractionation tests were also made on each pulp.

The results of the study are shown graphically in Figure 1. Opacity values interpolated at a constant brightness of 68 per cent decreased as the pulping temperature was increased. This effect was most pronounced for the pulps of low freeness. Figure 1 also shows that decreasing the freeness increases the opacity. For example, decreasing the freeness of pulp (produced at 25°C.) from 300 to 100 milliliters increased the opacity of the sheet about four percentage points at a brightness of 68 per cent.

Other results obtained in this study were as follows: (1) Opacity, at a constant brightness, increased as the fraction of fine fibers was increased. (2) At an average pulp yield of about 91.5 per cent, the amount of caustic soda consumed was not changed by variations in treating temperature. (3) The brightness of the unbleached pulps decreased from about 40 to 37.5 per cent as the pulping temperature was increased in this range.

Refining. — According to Parsons, *(4)* the amount of light scattered by pulp in a sheet can be increased by increasing the unbonded fiber surface area in the sheet. This increase in light scattering power, and resultant increase in opacity, could be presumably brought about by either cutting the fibers into smaller particles to increase the surface area or using less pressure in wet pressing the sheet to decrease the bonded

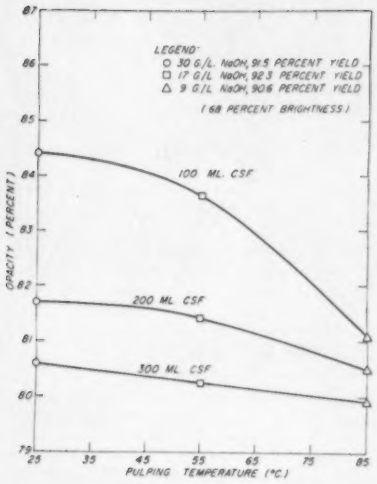


Figure 1—Effect of pulping temperature and of freeness on opacity.

surface. The purpose of the work reported in this section was to determine the suitability of three types of pulp refiners to increase opacity.

Disk milling: Cold soda pulp produced from the mixture of 6 hardwoods under conditions given in Table VIII was refined to various freenesses by recycling through a 36-inch-diameter double disk mill. Decreasing the pulp freeness in this manner within a range of from 280 to 120 milliliters increased the amount of fine fibers passing through a 200-mesh screen in a range of from 23.7 to 28.0 per cent. After the pulps were each bleached with 12 per cent available chlorine in the form of calcium hypochlorite, tests made on handsheets showed that refining in the disk mill was effective in increasing both the opacity and strength of the pulp (Table VIII).

Beating: The bleached pulp from the last stage of refining in the disk mill was beaten in a test beater of 1.5-pound capacity until its freeness was about the same as that of commercial book-grade groundwood pulp. Beating increased the strength and density of the cold soda pulp considerably but decreased its opacity two percentage points (Table VIII). The decrease in amount of fines after beating (Table VIII) might be partly caused by increased coagulation of hydrated fibers in the screen classifier.

Jordaning: Bleached cold soda groundwood-type pulp prepared from a mixture of southern red oaks was subjected to a single pass through a laboratory jordan, using a moderate amount of pressure. Handsheets made from the pulps before and after jordaning were wet pressed at pressures of 10, 100, and 300 pounds per square inch (gage). Refining this pulp in the jordan decreased its freeness from 130 to 70 milliliters and also decreased both the opacity and brightness of sheets pressed at given pressures, as shown in Figure 2. This refining action increased both the density and strength (as measured by breaking length) of the pulp. If the curves in Figure 2 are used to compare the jordaned and unjordaned pulps at constant values of density and brightness in a range of wet press pressure of from 100 to 150 pounds per square inch (gage), this refining action appears to have had no effect on opacity.

Brightening. — The typical effect on opacity of brightening cold soda

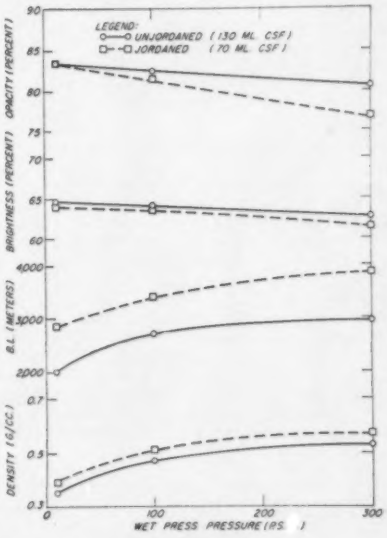


Figure 2—Effect of jordaning on opacity and brightness.

groundwood-type pulp is shown in Figure 3. Increasing the amount of applied available chlorine from 8 to 10 per cent (based on the moisture-free weight of the pulp) in bleaching a southern red oak cold soda pulp with calcium hypochlorite decreased its freeness from 85 to 70 milliliters and increased its brightness about three percentage points. At a given wet press pressure, this increase in brightness was accompanied by a decrease in the opacity of the handsheet of about two percentage points, as shown in Figure 3. Increased brightening strengthened the pulp slightly (as measured by breaking length) without changing its density.

Wet pressing.—As indicated in Figures 2 and 3, increasing the pressure during the wet pressing of cold soda pulpsheets increases both their densities and strength properties but makes them darker and more transparent.

Pulp color. — As mentioned before, treating wood with caustic soda at low temperatures gives the fibers a yellowish cast that persists even after bleaching. This color becomes noticeable in printing paper if more than about 25 per cent of cold soda is present in the sheet. An experiment made on aspen sawdust to determine the cause of the yellowing involved treating samples with a 50-gram-per-liter solution of caustic soda for two hours at atmospheric conditions after they had been extracted successively with ether, alcohol-benzene, and hot water. Treatment of the sawdust after each extraction produced the same characteristic yellow color as treatment of an unextracted sample. But the color of a sample of Cross and Bevan cellulose prepared from the sawdust did not change after a similar treatment with caustic soda. This result supports the common belief that the yellow color is produced by the reaction of the alkali with lignin.

Multi-stage bleaching might be an effective way to remove the yellow color from cold soda pulp, but it would probably be costly. Experience has shown that the brightness and degree of yellowness of cold soda pulp depend partly upon the extent of washing given the pulp. In one series of experiments, the brightness of unbleached aspen cold soda pulp was increased from 49.0 to 54.3 per cent by pressing out some of the colored liquor from the treated chips by a single pass through a screw press, before the chips were fiberized in the disk mill. Bleached pulp pro-

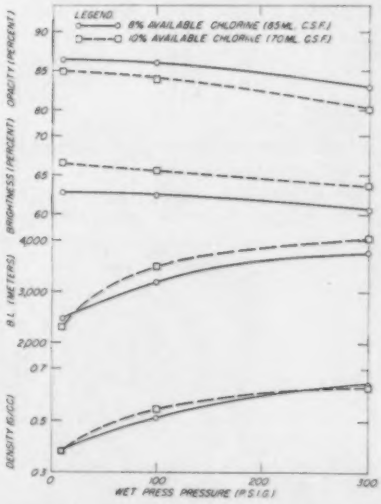


Figure 3 — Effect of bleaching on strength and opacity.

duced from the pressed material appeared to be somewhat less yellow. The use of surfactants in conjunction with washing operations also seems to have promise for improving the color of cold soda pulp.

Conclusions

It may be concluded that:

1—The rate of distribution of caustic soda solution to the centers of hardwood chips during pulping by the cold soda process can be accelerated by either preevacuating the treating vessel, increasing the hydrostatic pressure during steeping, or decreasing the chip size.

2 — Air-dry wood absorbs more liquor, consumes more chemical, and produces less cold soda pulp at a given level of strength than green wood.

3—Optimum treating temperature in the preparation of cold soda groundwood-type pulps is about 25°C. from the standpoint of opacity and color.

4—The opacity of bleached cold soda pulp can be increased by disk mill refining.

5—If it is important to preserve opacity, cold soda pulps should be bleached only to the minimum acceptable brightness and their densities should be kept at the minimum level necessary to obtain the desired strength in the paper.

6—The addition of surfactants to cold soda pulping liquor accelerates its penetration into wood with low moisture content and also improves washing operations.

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Correction

An unfortunate error occurred in the heading of the article on bleaching groundwood from chips in our December 23rd issue. This should have read "A combination of peroxide and hydrosulphite (*not hypochlorite*') was found most effective." Our apologies.

NEW LITERATURE

BROOKSEAL DIAPHRAGM SEALS. (Bulletin 250) Includes cross section drawing of cleanout type seal, as well as drawings of six other types. Also lists materials of construction and outstanding features. **Brooks Rotameter Co.**, Lansdale, Pa.

CLAMSHELL BUCKETS. (Bulletin A-266) Gives complete specifications and job action photos of both the general purpose ⅜ yd. and special ½ yd. rehandling buckets. **Schield Bantam Co.**, Waverly, Iowa.

EDUCTOR AND MULTI-JET CONDENSERS. (Bulletin 5AB) Contains application, construction, and operation information on both types of condensers. Complete sizing data is included for both types and sizes available, capacities, weights, and dimensions are provided in tabular form. **Dept. JA-10, Schutte & Koerting Co.**, Cornwells Heights, Bucks County, Pa.

CONDENSED REFERENCE FILE. (Booklet) Includes thumb-indices to aid in finding data on polyethylenes, vinyls, styrenes, phenolics and epoxies. Also provides illustrations of products made from these plastics. **Bakelite Co., Div. of Union Carbide Corp.**, 30 E. 42nd St., New York 17, N. Y.

EFFECTS OF REPEATED ACID CLEANINGS ON BOILERS, HEAT EXCHANGERS AND PROCESS EQUIPMENT. (Bulletin) Includes a few representative case studies from laboratory records showing how many times metal surfaces can be cleaned by chemical means without weakening the metal and tells why their service is best for your equipment. **Dowell Incorporated**, Box 536, Tulsa 1, Oklahoma.

LIQUID METER CONVERSION KITS. (Bulletin OG-641) Describes new crank-control conversion kit for increasing life of old model Rockwell Rotocycle liquid meters. **Rockwell Mfg. Co.**, 400 N. Lexington Ave., Pittsburgh, Pa.

MECHANICAL POWER TRANSMISSION AND CONVEYING MACHINERY. (Catalogue 610) Contains descriptions, specifications, application information and selection data on products for power transmission, conveying and elevating service. **Chain Belt Co., Sales Promotion Dept.**, Milwaukee 1, Wis.

SELECT-A-SPEDE ADJUSTABLE SPEED DRIVE. (Bulletin 2000) Describes this unit which is a variable-voltage DC drive that uses AC as its power source. Discusses and illustrates applications such as machine tools, metal processing, textile, paper making, test stands, conveyors, etc. **Louis Allis Co.**, 427 E. Stewart St., Milwaukee 1, Wis.

SURE-FLEX COUPLINGS. (Bulletin 10100) Tells how to select these couplings which are suited to more than 150 different service applications. Five tables short-cut the usual engineering calculations and give the right answer in a matter of seconds, taking all factors into consideration. **T. B. Wood's Son's Co.**, Chambersburg, Pa.

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1957 has been a year of contrasts.

Significant advances in technology, the completion of a substantial portion of our program to expand our productive capacity in the U. S. and Canada and the strengthening of our marketing organization are all tangible achievements which will bring us both immediate and long-term benefits. On the other hand, a generally lower activity in new projects coming in has emphasized the narrowing profit margins faced by most businesses and points up our insistence on improving designs, reducing costs and increasing efficiencies.

Abroad, the picture is bright. Our subsidiaries report current high levels of business and there is great optimism for the future. Of particular interest is the success of our newest family member, Dorr-Oliver Pty. Ltd. of Australia, which opened its doors on January 1 of this year and by mid-year had far surpassed expectations. Growth of Dorr-Oliver (India) Ltd., another of our newer associates, has also been noteworthy, with the recent addition of local manufacturing facilities justifying still greater optimism.

SUGAR — In 1957 a total of 42 RapiDorr Clarifiers and 48 Oliver-Campbell Cane Mud Filters were sold to the cane sugar industry. A significant aspect of this outstanding record has been the increasing participation of our subsidiaries and representatives abroad. They are locally manufacturing, in some instances for the first time, 31 of these machines in Argentina, Brazil, England, France, Germany, India, the Philippines and South Africa.

SANITATION — One of the highlights of the year was D-O activity in the waste water disposal field. Four major new developments — all ideally suited for smaller plants — were introduced. The SpiroVortex System which is a complete treatment process akin to activated sludge, the Degritting Clarifier and Clarigester and the DorrClone Classifier as applied to sewage degritting have already been commercially proven at plants in the western U. S. First installations of the CompleTreator, a package plant to serve a population of 150, are now operating with some 30 additional units scheduled to start up in 1958.

Our subsidiary in the Netherlands has marketed equipment for facilities as far distant as Norway, Iraq and India, while new or enlarged D-O equipped domestic installations sold in 1957 can be found from New York City to Los Angeles and San Antonio, Texas to Fairmont, Minnesota.

PULP AND PAPER — Another operating "first" recorded during the past year was initial operation of the first complete D-O Pulp Bleaching System. Located at a northern New York state mill, it is the result of an extensive program to develop a new and improved continuous bleaching system for the pulp industry. Abroad, the Swedish representative of our Dutch subsidiary has just completed an outstanding year marked by one of the largest orders in their history for Bleach Washers and by orders for a number of new or expanded Recausticizing Systems.

GENERAL METALLURGICAL — Applications of the DSM Screen, first introduced in 1956, continued to grow in virtually every field we serve. One of the most promising has been magnetite recovery in heavy media cyclone plants on the Mesabi Range. Also new is the swing-type agitator for the American Filter — a development particularly applicable to filtration of heavy metallurgical slurries.

Following the trend noted in previous years, widespread acceptance of the Slurry Mixer by the cement industry and the Thickener — American Filter combination by the coal industry continued again last year. In Germany, France, India and Australia flue dust clarification and recovery contributed materially to our business and in Canada a substantial volume of Dorr-Oliver-Long shaft equipment and mine cars was purchased for underground mines.

PLANT ENGINEERING—At the year's end, design of a granular fertilizer plant for India and sections of a new Cuban nickel recovery plant were partially completed, and construction of three D-O designed phosphoric acid or fertilizer plants was progressing in Venezuela, England and Montana. During the year a 200,000 ton per year triple superphosphate plant in Florida and a Norwegian phosphoric acid installation were put into operation and brought up to design capacity in near record time.

FLUOSOLIDS SYSTEMS — Also in the fertilizer industry two western producers ordered the first FluoSolids Systems to be used for calcination of phosphate rock. Designed to handle a total of 1,500 tons per day, these installations were the direct result of successful field tests using a portable fluidized bed pilot plant. During the year other FluoSolids Systems were ordered to dry limestone and blast furnace slag in the U. S., roast copper matte in Belgium, calcine clay in Scotland, decompose copperas in England, and roast pyrite for a Japanese paper mill and an Italian sulfuric acid manufacturer.

The largest FluoSolids System for fine coal drying, handling over 600 tons per hour, went into operation during the third quarter at a new eastern preparation plant, and construction is nearing completion on a second similar, but smaller, installation. In the realm of unusual applications is a unit drying a highly-corrosive chlorinated hydrate at an eastern chemical plant.

WATER TREATMENT — In the southwestern United States the DorrClone Classifier has been used with notable success for the desanding of municipal well water supplies. For small plants the PeriFilter System with a single pre-treatment unit and split filter provides economical unitized water treatment.

Major expansions of the Louisville, Kentucky and Fort Worth, Texas treatment facilities will be D-O equipped as will new municipal plants at Springfield, Ohio; Peoria, Illinois; and Delhi, India. New industrial treatment installations will serve pulp mills in South Carolina, India and Venezuela and an Indian fertilizer plant.

PETROLEUM — Another modification of the familiar DorrClone Classifier is the Clay-Jector, latest development for control of drill mud weights. Noteworthy economies are possible using this unit which mechanically rejects undesirable drilled solids while recovering valuable barites for reuse.

CHEMICAL — A substantial amount of D-O equipment of all types has been incorporated into the unique flowsheet of a new astrakanite recovery plant in the Chilean nitrate fields. In Germany and the United States, Horizontal Filters have been widely applied to dewatering and washing of fine organics as well as highly corrosive inorganics, and around the world filters of both standard and special construction were ordered for an almost endless variety of services.

FOOD PRODUCTS — A mid-western producer has ordered twelve centrifugals of three basic types for washing and concentrating soya protein solids. Last year the largest U. S. corn starch producer put into operation a Merco-DorrClone starch washing system, and in 1958 the first DorrClone germ separation station in the same industry will go on stream. Also in centrifugals, a smaller model of the Mercone Screening Centrifuge is now available for intermediate or small scale operations.

With several years of expansion and enormous activity behind us, the current business plateau provides a much needed opportunity to consolidate and catch our breath. The real challenge will be to increase the spread between income and outgo through more efficient operation — while accelerating the rate of our technological advances. I am confident we can, and will, do both.

J. D. Hitch, Jr.
President

November 18, 1957

FluoSolids, DorrClone, PeriFilter and RapiDorr T.M. Reg. U. S. Pat. Off.

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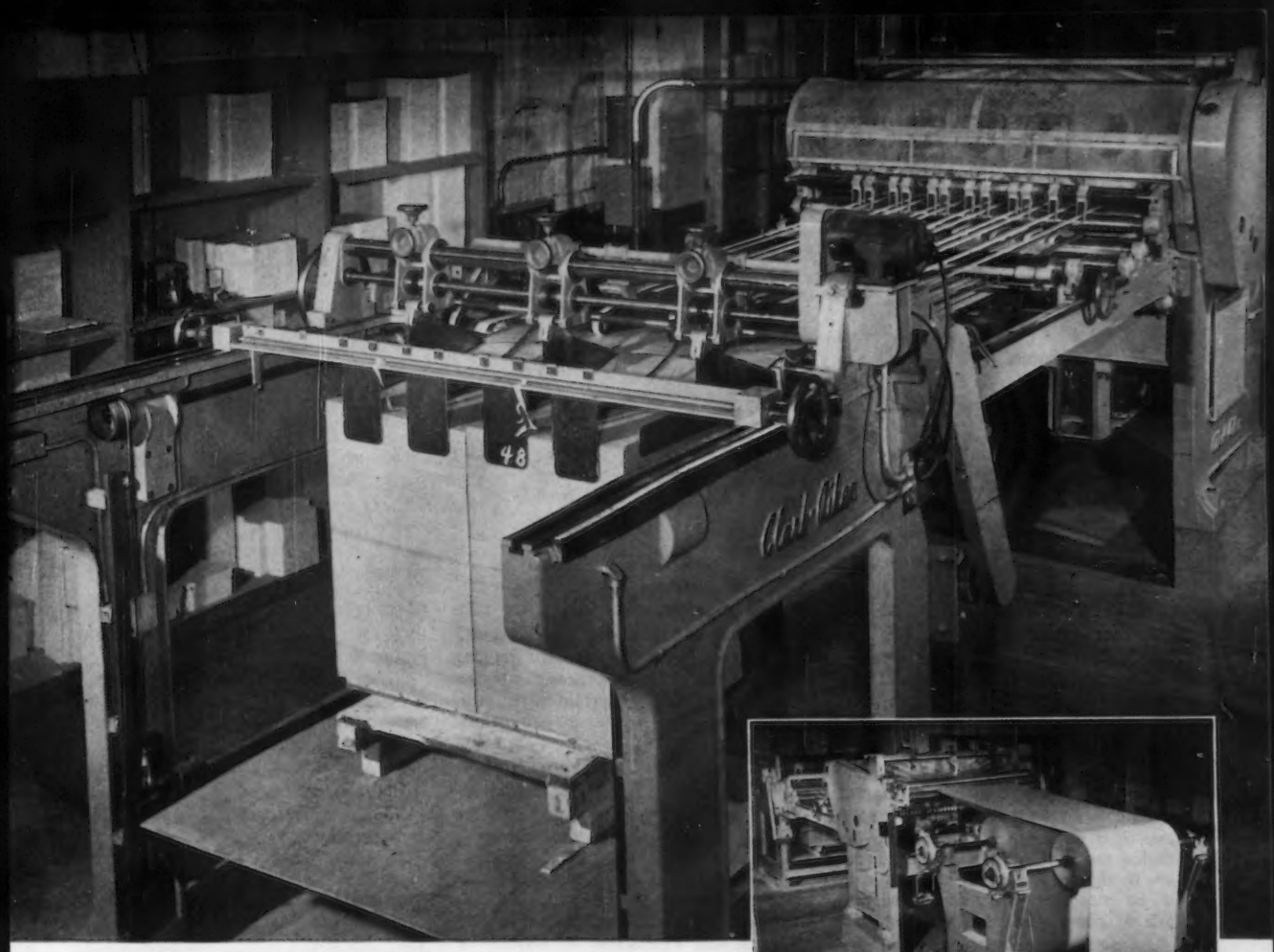

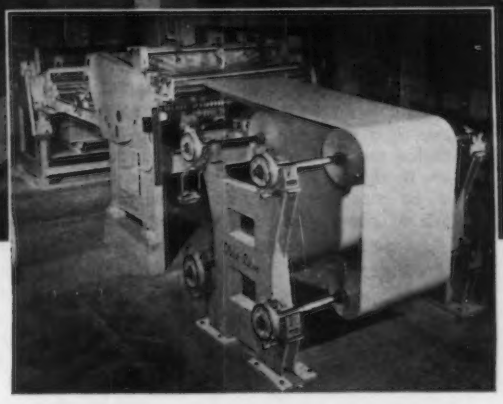

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Principles and Methods of Screening Groundwood

Dr. K. H. Klemm

Manager, München Dachauer Papier Fabriken
Munich, Germany

English text by
G. P. Chinn

The screening of groundwood is a field where basic fundamental knowledge is largely missing. The arrangement of groundwood screens has, therefore, usually been done on an empirical basis. Here too, a more objective consideration of the problem should result in the disclosure of certain basic facts which will permit further progress. With increasing paper machine speeds, more rigid requirements have been demanded from groundwood screens, for even though a low sliver content may not be necessary for the particular grade of paper, the running conditions of fast paper machines require it.

To date, neither the manufacturers of screens nor the mills themselves have established standard figures to express the efficiency of screens and screening systems. In mills producing the finer grades of paper, where the sliver content of the accepted stock is most important, this figure is used for judging the efficiency of the screens. In newsprint mills, where a certain sliver content can be tolerated, screens are usually selected according to their capacity. Such figures give no really useful information which can be applied in the design of new screening systems and these must, therefore, still be planned on a strictly empirical basis. In the following, a system for establishing the efficiency of screens is presented. By this method, from measurements made during practical operation, it should be possible to fill in the gap in our knowledge of the fundamentals of groundwood screening. The modern developments in the field of screening and refining are shown and data for their normal operation are given. Example flow sheets of modern screening systems are discussed and the relationship between production and the amount of recirculation within the screening system shown.

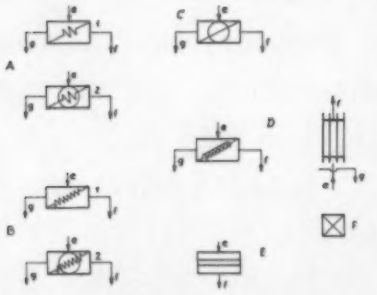


FIGURE I—SYMBOLS FOR REPRESENTATION OF DIFFERENT SCREEN TYPES
A—Vibrating screen (low frequency). 1. Flat screen. 2. Cylindrical screen; B—Vibrating screen (high frequency). 1. Flat screen. 2. Cylindrical screen; C—Centrifugal screen; D—Vortex screen; E—Refiner screen (combination); F—Chests. (e) Feed, (f) Rejected Stock, (g) Accepted Stock
(The numbers represent the screen stage).

Basic Principles

Only recently, Steenberg (1) discussed the fundamentals of the screening of fibrous suspensions and Ranhagen (2) presented a survey on the different screen types. At the inlet of screens there is always a mixture of good fiber with splinters and dirt. The aim of any screening must be to separate this mixture into two fractions; the one containing only the good fiber without any slivers or dirt, and the other only slivers and dirt and no useful fibers. In practice, this aim cannot be realized because there are no known mechanisms which provide an absolute barrier against slivers and dirt. There is also the second possibility of a failure in a screen design, namely, rejection of good stock. Data on screens which do not include information on these two basic failings are without any practical use.

From the consideration of the operating principles of a screen, three points appear most important for the final effect of the screening operation:

1—The amount of slivers and dirt in the stock delivered to the screens.

2—The consistency during the screening operation.

3—The retention time in the screen.

Amount of Slivers, Dirt in Feed

Using the extreme case, if the stock delivered to the screen consists entirely of dirt and slivers, it can be seen that only dirt and slivers can pass the screen plates. From this, it can be concluded that the conditions for effective screening become improved as the amount of splinters and dirt in the entering stock decreases. As this amount is always considerably higher in the later stages of a screening system than in the first stage, the screens used here have to work under appreciably more difficult conditions.

Consistency During Screening

The consistency during the screening operation is important for the prevention of flocculation or the build-up of a filter layer on the screen plates. Therefore, it is essential that the right dilution be maintained during the entire screening operation. To guarantee this, relatively large quantities of shower water are needed. Flocculation can be avoided by introducing vibrations and this is the main reason for the high capacity of the vibrating type screens.

Retention Time in Screen

The retention time is the main factor which influences the possibility of coarse stock and dirt passing the screen

plates. This point of view is seldom considered and not enough attention is paid to the speedy removal of the rejected stock.

Types of Screens

The screening operation, of course, is dependent upon the type of screen and the perforations of the screen plates. These must be selected according to the characteristics of the stock to be screened. For groundwood screening, the main types used are vibrating screens, centrifugal screens and, more recently vortex screens(3). Whereas with vibrating and centrifugal screens, perforated or slotted plates are used to achieve the screening effect, with the vortex screens the dirt and slivers are separated by the centrifugal effect of the different velocity layers.

In Figure 1, symbols for the various types of screens (as introduced by Steenberg) are presented. The vibrating screen with low frequency, such as 1) flat screens and 2) screens with rotating cylinders, is shown in (A). Only the flat screen type is used in groundwood production (e.g. the "Neithammer" as a coarse screen). The vibrating screens with high frequency (B), were advanced especially in Sweden and are characterized by being able to operate at relatively high consistencies. As flat screens 1) with perforated plates (Jonsson, Allis-Chalmers and Ahlfors), they are commonly used as coarse screens and between the different stages of the fine screens. As vibrating and rotating cylindrical screens 2), they are used with slotted screen plates in the later stages of groundwood screening systems (Lindblad and Lindgren screens). The disadvantage of screens of the types (A) and (B) is that no particles with a thickness equal or less than the width of the slots or diameter of the holes are rejected. If very high screening efficiency is required, very fine perforations must be used and, with this, the relatively high capacity is greatly reduced. A uniform rate of feed is very important with this type of screen.

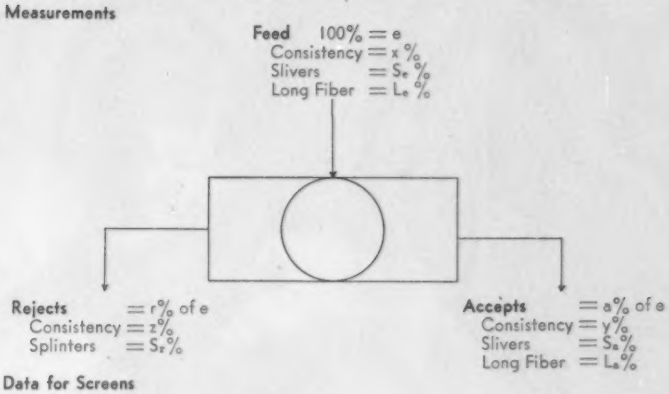
The modern centrifugal screens (C) are characterized by being very efficient for the removal of long fibers and coarse fiber bundles. However, spherical and cubical dirt having diameters up to that of the screen holes is not rejected. In addition, there is a certain defibering effect and, especially with screens having high shaft speeds, the slivers become shortened and pass the screen as short and thick particles. The long fiber content is higher and the fines lower at the inlet than in the accepts. With this type of screen, it is important to set and control the rate and consistency of the feed according to the character of the stock. As the major part of the acceptable fibers and of the water has already passed through in the first third of the screen length, the screening becomes harder over the remainder of the plate. Compensation can be made for this by having slightly larger perforations in the last two-thirds of the plates and by adding more dilution water. Among the well-known centrifugal screens having a horizontal shaft are the Biffar, Cowan, Waterous Hydrofoil, Voith centrifugal and the Voith Durchfluss (Through-pass). The Rottrom screen of the Miag Co. is equipped with a vertical shaft.

The vortex screens (D) are especially suited for the removal of particles having a higher specific gravity than the fibers (e.g. pulpstone grits). In addition, they are also capable of removing a considerable amount of other dirt (particularly short, thick slivers and pieces of bark). This latter effect is especially applicable to this type of screen working with a free vortex. The vortex type screens have only recently been introduced into groundwood systems. As the power con-

(Continued on page 40)

TABLE I—CALCULATIONS FOR SCREENING EFFICIENCY

A. Measurements



B. Data for Screens

I Screen

(a) Capacity—tons (o.d.)/24 hrs.
(b) Motor—h.p.
(c) Specific Energy Consumption—h.p. day/ton (o.d.)
(d) Perforation of Screens—inches
(e) Speed of Screen Shaft—r.p.m.
(f) Shower water Consumption—USGPM/daily ton (o.d.) = Q

$$Q = \frac{a\left[\frac{1}{y} - \frac{1}{z}\right] + 100\left[\frac{1}{z} - \frac{1}{x}\right]}{6.02} \qquad (17)$$

II Feed

(a) Consistency—%
(b) Slivers — % absolute
(c) Long Fiber Content — % absolute
(d) Freeness

III Accepted Stock

(a) Consistency — %
(b) Accepted Stock (% of Feed) $\quad a = 100\,\frac{S_r - S_e}{S_r - S_a}\,\%$ (18)

(c) Long Fiber Yield
(d) Slivers Content — % absolute $\quad Y_L = a\,\frac{L_a}{L_e}\,\%$ relative (19)

IV Rejected Stock

(a) Consistency — %
(b) Rejected Stock (% of Feed) $\quad r = 100 - a\ \%$
(c) Good Stock Loss — % relative $\quad Y_g = 100 - a\,\frac{100 - S_a}{100 - S_e}\,\%$ relative (20)

(d) Sliver Yield — % relative $\quad Y_s = 100 - \frac{S_r(S_e - S_a)}{S_e(S_r - S_a)}\,\%$ relative (21)

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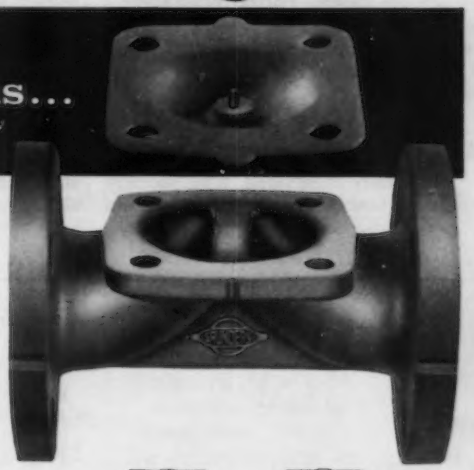

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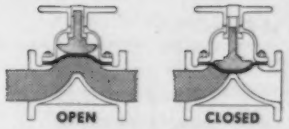
Case 1. Benzene hexachloride (30%-40% benzene, free chlorine); 120 to 130 F, 10 to 20 psi; operated 3 to 4 times daily	Glass lined bodies; Teflon Diaphragm; 1 to 3 inches	10 to 14 mos.	1 to 2 mos.
Case 2. 90%-95% HNO_3 plus 1.8% HF (specific gravity 1.62—1.77) 115 F in summer; 40 F in winter; 125 psi; operated 2 to 3 times daily	Durimet 20 body; Teflon Diaphragm; 1 to 3 inches	8 months	2 months
Case 3. $AlCl_3$ complex; ambient to 220 F; 0-50 psi; operated 1 to 2 times daily	Glass lined bodies; Teflon Diaphragms; 1 to 4 inches	9 months	6 months
Case 4. Sulphuric acid 85%; outside temperature; no pressure; operated 4 times daily	Iron bodies; Teflon Diaphragms; 2½ inches	Still in service after 1 year	3 weeks



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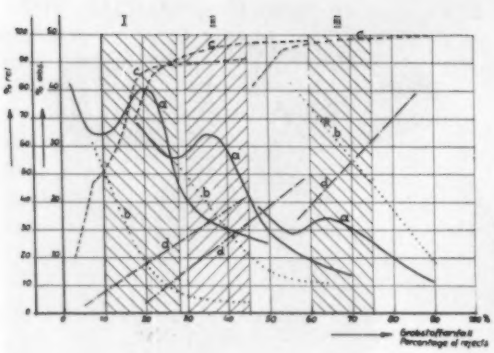

FIGURE 2 — EFFICIENCY OF SCREENS IN THE VARIOUS SCREENING STAGES AS SHOWN BY THE LONG FIBER CONTENT.

(Continued from page 37)

sumption is relatively high, very often they are used only for double screening the accepted stock from the later screening stages. Vortex type screens are available in a wide variety of types and dimensions (e.g. Bauer Cleaner, Dirtec, Vortrap, Vorject and Voith Rohrschleuder).

Efficiency of Screens

As already mentioned, until recently no data was available which showed the efficiency of the different screen types sufficiently. One of the reasons for this was that, in the past, efforts were made only to establish the efficiency of screens in absolute figures. However, because of the varying conditions, figures should always be relative and related to the character of the incoming stock as it is characterized by the use of classifiers. This is the only way to guarantee a common basis for comparison. In addition, by using this method, the results become practically independent of the type of classifier or the testing procedure and, therefore, the data can be used for general comparison purposes between different mills. Klemm (4) proposed a system for the evaluation of screening efficiency including a method of measurement and calculation which permits the efficiency on individual screens or screening systems to be determined during practical operation*. If one common characteristic component from two branches of a common stream is known together with the quantity of one of these streams, the quantity in the two others can be calculated. However, as arranged in practice, it is usually very difficult to measure the volume of even one of these streams. Very useful information can still be obtained by determining the percentage of the two branch streams and assuming the quantity in the main stream to be 100. To apply this method to screens, the sliver content of the three streams is chosen as a common characteristic component. All the formulae required for determining screen efficiency are given in Table I.

* The method of calculation employed has already been proposed by Paterson (5).

TABLE II—EFFICIENCY OF SCREENS IN DIFFERENT SCREENING STAGES

	1st STAGE				2nd STAGE				REFINER STAGE		
	Normal Range*	Example Screen Types**			Normal Range*	Example Screen Types**			Normal Range*	Example Screen Types**	
Location of Screen		Cowan	Rotrom	Voith Durchfluss		Rotrom	Voith Centrifugal	Waterous***		Voith Centrifugal	Trimbey
I Screen Data											
(a) Capacity—tons (o.d.)/day	25-100	100	65	45	10-65	40	20	40	10-20	16.5	14.5
(b) Motor—h.p.	35-60	60	45	45	25-40	25	85	90	35-40	35	40
(c) Specific energy consumption —h.p. day/ton (o.d.)	0.6-1.6	0.6	0.7	1.1	0.75-3.3	0.6	1.4	2.2	1.5-3.5	2.0	2.8
(d) Perforations—inches	0.050-0.085	0.055-0.065	0.085	0.050	0.045-0.080	0.090	0.055	0.070	0.035-0.060	0.035	0.075
(e) Shower water—USGPM/daily ton (o.d.)	1.0-12	8.2	1.1	6.6	10-17	14.5	14.5	19.0	16-53	49	14.3
II Feed Stock											
(a) Consistency — %	0.5-0.9	0.82	0.53	0.68	0.6-1.1	0.42	0.70	0.44	1.0-1.8	1.5	0.34
(b) Sliver content — % absolute	1.8-5.1	4.5	5.1	1.6	12-30	12.1	22.0	48.0	23-52	42.0	28.6
(c) Long fiber content — % absolute	12-24	19.6	18.5	14.6	18-32	26.5	31.8	35.0	30-45	38.6	31.0
(d) Freeness — Canadian standard	100-140	100	115	110	175-360	255	400	600	425-700	425	600
III Accepted Stock											
(a) Consistency — %	0.5-0.7	0.59	0.50	0.48	0.3-0.5	0.24	0.28	0.10	0.2-0.4	0.14	0.18
(b) Accepted — % of feed	90-**81**-72	92	83	78	70 **65** 55	64	49	30	40 **35** 25	33	55
(c) Long fiber yield — % relative	65-**80** 50	65	78	66	58 **65** 42	57	49	22	32 **34** 25	19	51
(d) Sliver content — %	2.5 **1.0** 0.4	2.4	1.2	0.6	2.5 **1.7** 1.0	1.4	2.1	9.2	3.7 **3.2** 2.3	2.0	15.2
IV Rejected Stock											
(a) Consistency — %	0.6-0.9	0.85	0.74	0.78	0.7-1.2	0.74	1.1	0.9	0.8-1.5	0.65	0.75
(b) Rejected — % of feed	10 **19** 28	8	17	22	30 **35** 45	36	51	70	60 **65** 75	67	45
(c) Good stock loss — % relative	8 **16** 26	6	13	21	15 **23** 32	27	38	68	38 **45** 61	44	65
(d) Sliver yield — % relative	50 **86** 89	44	81	87	92 **95** 97	92	95	97.5	96 **97** 98	98	70

* The data indicate what a screen should do in the equivalent screening stage. The heavy type figures represent the optimum, and the others, the limits for sharp and soft screening respectively.

** The data given do not necessarily represent the optimum results obtainable for the particular screen but only measurements which have been made on them during normal operation.

*** The data shown for this screen are the result of the coarse character of the feed as obtained in North American screening systems which employ "sharp" screening in the first stage. They compare with the characteristics as obtained in the third stage of European systems.

To show the screening efficiency, it is first necessary to describe the composition of the stock at the inlet. This can be done by stating the consistency, freeness, sliver content and long fiber content. The efficiency of a screen is best expressed by giving the percentage of the accepted and rejected stock. However, these data are only useful if, at the same time, the two characteristic failings of a screen (i.e. slivers in the accepts and good stock in the rejects) are known along with the amount of defibering. Therefore, the information required to give a true picture of a screen's efficiency is:

Feed: freeness (Canadian Standard)
sliver content (per cent absolute*)
long fiber content (per cent absolute*)

Accepted Stock:
the sliver content (per cent absolute*)
the long fiber content (per cent relative*)
the sliver content (per cent relative*)

Rejected Stock:
the sliver yield (per cent relative*)
the good stock loss (per cent relative*)

Construction Details:
capacity
size of screen plate perforations
amount of shower water used
the r.p.m. of the shaft
the power required per daily ton of production.

Once this data has been established, the screen performance can be completely described so that a comparison can be made with other screens in the same mill and also with the experience in other mills too. This will, at last, permit a really objective exchange of information and experience between mills. Besides this, the accumulation of such data can be used as a basis for the examination of the screens presently available, for the construction of new screen types and for the development of new screening systems. Figure 2 shows the results of a graphic evaluation of about 30 sets of measurements of this kind made on the various types of screens. The surprising fact shown up in the graph is that all these measurements, despite very different working conditions, give the same results when plotted against the percentage of rejects and, that it clearly differentiates the various screening stages. It would seem that the distinct maximum of the long fiber yield which occurs in each stage, is of major importance. With this, the possibility is provided of choosing the optimum working conditions of a screen within each stage. In Table II, both the optimum point and the range for favorable working conditions are given together with some examples of test results on different screen types. It can be clearly seen that the conditions become more and more difficult in the later screening stages. The high sliver content in the feed requires a high sliver yield in the rejects if the sliver content in the accepted stock is not to exceed that which is permissible. The actual practice of screening in stages is usually done without regard to the coarse character of this pulp and relatively fine screen plates are used. This results in a very low long fiber yield and high stock recirculation within the refiner stage. The development of special screens for the later stages of screening system, therefore, appears to be an urgent need.

I—Optimum working range for the first screening stage (Normal feed; 4.6 percent sliver content, 22 percent long fiber content).

II—Optimum working range for the secondary screening stage (Normal feed; 19.5 percent sliver content, 22 percent long fiber content).

III—Optimum working range for the coarse stock stages (Normal feed; 38 percent sliver content, 32 percent long fiber content).

(a) Yield of long fiber in accepted stock—percent relative.

(b) Sliver content in accepted stock —percent absolute.

(c) Yield of sliver in coarse stock—percent relative.

(d) Good stock loss in coarse stock —percent relative.

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* Percent absolute refers to the actual percentage in the stream being measured. Percent relative refers to the amount in the individual stream as a percentage of the equivalent figure in the entering stock.

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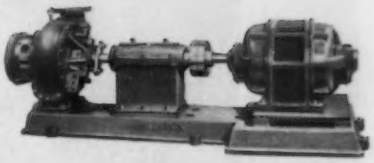

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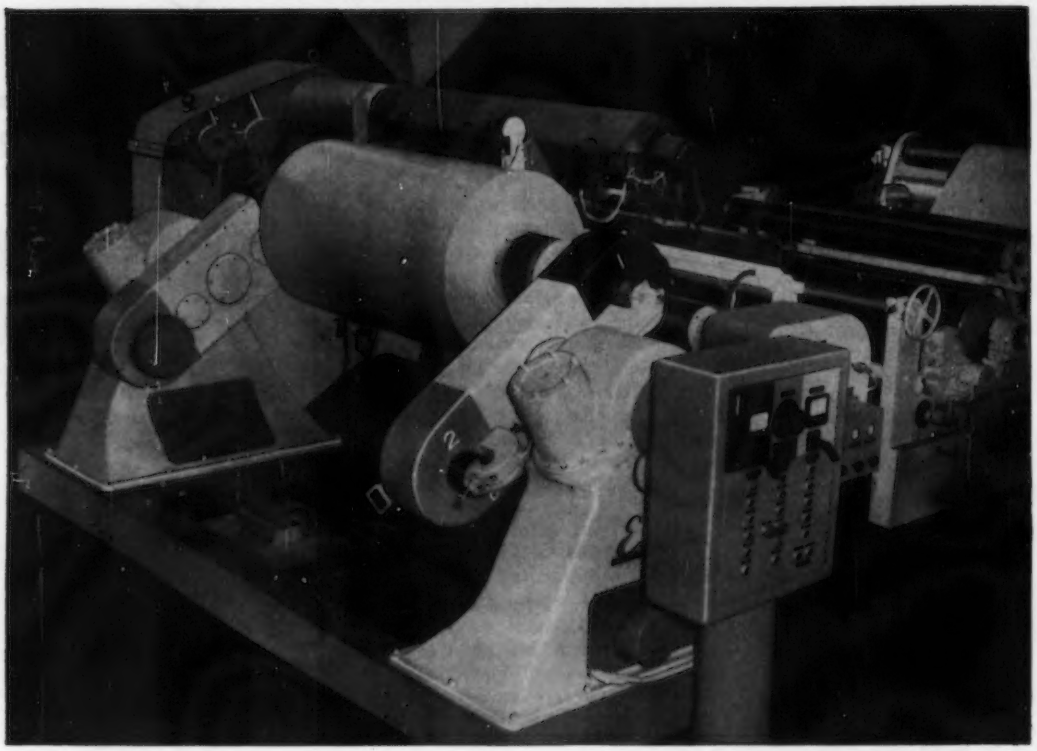

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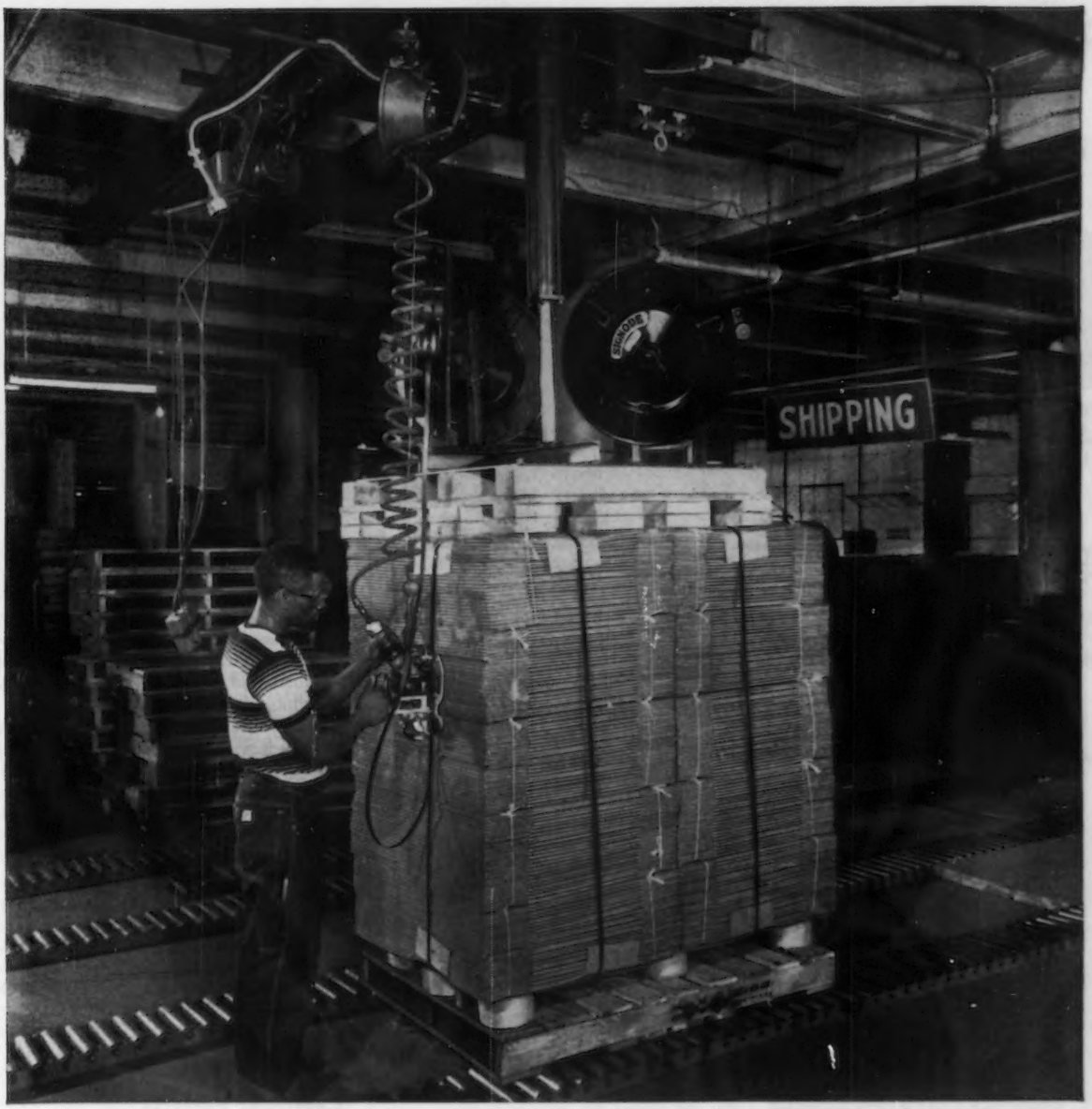

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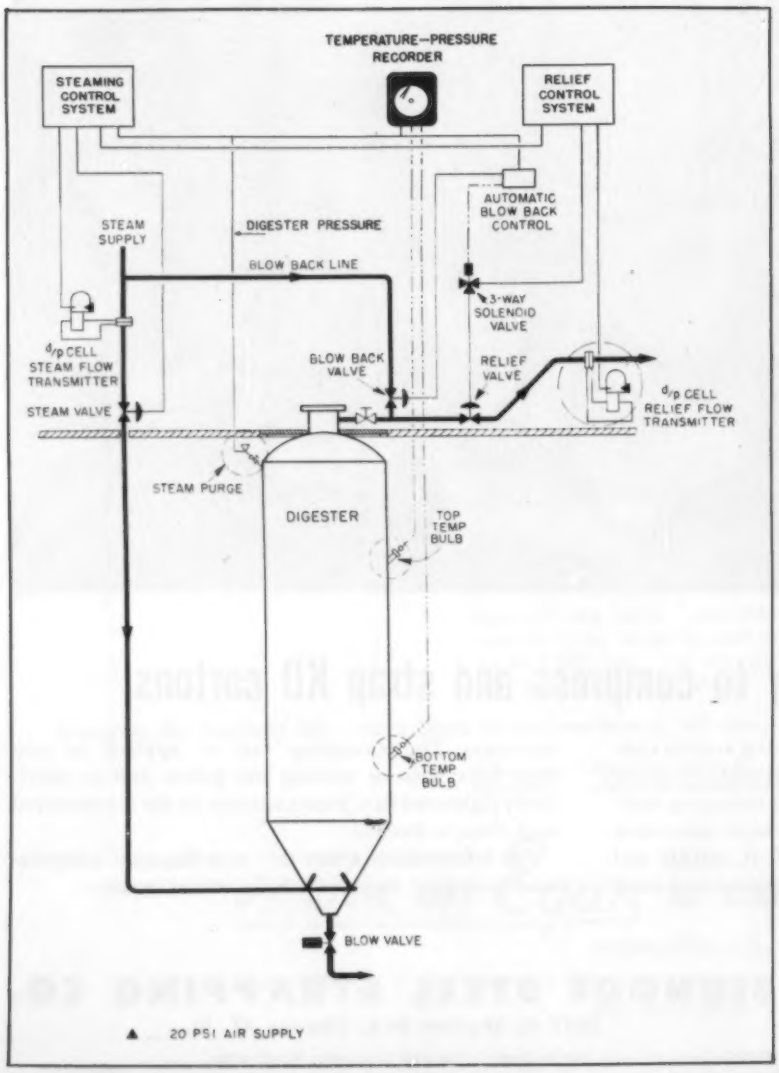


DETAILS OF NEW CONTROL SYSTEM

Southland Paper Mills produces newsprint and high grade food board. Pulp requirements for these two entirely different products are for a pulp easy to bleach and of uniform quality. It is important to have uniform permaganate numbers and low reject content for easy bleaching at low cost.

To produce a more uniform quality of pulp it was decided that the first step would be to improve cooking controls. At this time only manual controls were in use. Considerable work had been done to set up a satisfactory ratio of liquor to wood. Length of cooking time was limited due to lack of enough digesters to produce the amount of pulp needed. When manual controls are used the best results are not uniform, first because operators cannot repeat their steaming and relieving routine cook after cook, secondly steaming and relieving conditions vary from cook to cook.

Controller Features

It was decided to equip one digester with automatic controls in order to find how much improvement could be obtained. Several controllers were considered and each had some good points, however, the Foxboro Co. offered a controller with some features that carried the controlling a little farther than had been available. This controller included four features: temperature pressure recording; automatic steaming control; automatic relief control; and blow back control. Upon investigation of the performance of this controller in another mill, an improvement in liquor circulation and a lower more uniform reject content were evident; permanganate numbers also were more uniform, and a definite saving in steam was shown. On the basis of this performance and its extra control features, the Fox-

boro controller was installed in March of 1956.

The controller is enclosed in a cabinet with all recorders and control buttons in convenient locations on the front of the panel. All are easy to see and reach when necessary. The panel includes a temperature and pressure recorder; steam flow indicating controller; steam valve regulator for remote manual control; auto-manual switch for steaming; automatic blow back signal light; manual blow back panel push button; cam pressure controller; relief flow indicating controller; auto-manual switch for relief; and a relief valve regulator for remote manual control. This seems complicated when compared to a manually operated digester steaming and relieving system. The manual system required only a steam valve, a relief valve and a pressure temperature recorder and possibly a total steam flow recorder.

New System Eliminates Problems

When the control knob is turned to the automatic position, it starts the cooking cycle and continues it to final completion. The only requirement is for occasional inspection by the operator to see that all parts of the controller are in balance.

The temperature and pressure recorder has two pens—one showing pressure rise, the other showing temperature rise in both the top and bottom of the digester. The pressure is recorded in the dome of the digester. The temperature recorder is connected to both top and bottom bulbs and at given intervals records the temperature of the bottom of the digester, while continuously recording the top. The chart on which these temperatures and the pressure are recorded is scaled so that the pressure-temperature relation is in accordance with the steam tables.

A new type pressure controller has been in use for steaming control for some time, with the cam cut to give the desired rate of rise and cooking time. The new system eliminates several problems that go along with the cam pressure controller, primarily in the early stages of the cook. The new system eliminates these problems by combining steam flow control with scheduled pressure control. The flow controller operates in the early stages of the cook, admitting steam at a controlled rate. The cam follower rides the cam according to schedule but does not take control of the steam valve until the digester pressure exceeds the pressure indicated by the follower on the cam for rising pressure. Here is where the Auto-Selector shifts control from steam flow to a cam pressure schedule to complete the pressure rise on time. The flow and pressure controllers can both be set to any required cooking schedule.

Relief and Blowback Control Important

Another important Foxboro addition to automatic digester controls is the automatic relief controller. This method of relief actually measures and controls relief flow. Unlike the conventional temperature-pressure relation measurement for relief, the new flow method continuously compensates for relief screen coating; as the screen coating builds up, the controller automatically increases the relief valve opening to maintain the desired amount of flow. Indications thus far are that the flow method for relief improves liquor circulation. Another feature, and possibly the most important, is automatic variation of the amount of relief flow by the controller to minimize or prevent liquor pull-over. The amount of relief flow should not be confused with the valve opening. For a given amount of relief flow, the relief valve opening depends upon digester pressure, the amount of screen plugging and the back pressure in the relief header. At the start of the cook when digester steaming is heaviest, the amount of relief flow is held to a minimum by the control system to prevent pull-over. When the cam steaming controller takes over the steam flow drops off and the relief controller then increases relief flow to a maximum to maintain good circulation without pull-over.

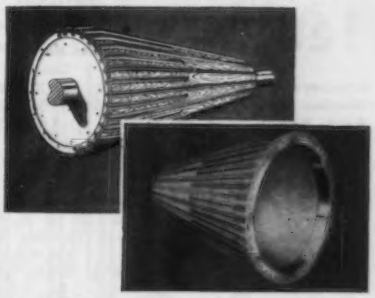
The fourth important addition to digester controls is the automatic blowback. During the early part of manual or automatic cook, digester steaming often causes false pressure in the bottom of the digester. This condition contributes to poor circulation and a poor cook. Automatic blowback provides high pressure steam to break up this false pressure or bubble and releases heat to both liquor and chips. This blowback occurs first on every cook at 35 p.s.i. and subsequently only if the relief screen coating becomes so severe that the relief valve goes wide open. In most cases three or four blowbacks per cook is all that is required even when a small screen is used.

Results Justify Automatic Control

Considerable data has been prepared since the time of this installation and the controller has proven of great value in maintaining uniform permanganate numbers, lower percentage of rejects and lower steam requirements, in addition to eliminating the element of human error. At Southland Paper Mills it is now planned to equip several more digesters with automatic controls.

REVOLUTIONARY ADVANCE

In Jordan Plug Design



In addition to the strongest and most adaptable solid plug ever developed, Adapta-Plug is available in sleeve form for easy, economical conversion of old worn plugs.

E.D. Jones Adapta-Plug

Completely bandless, easily stripped and filled. Inverted-wedge-type slots hold bars firmly in place, eliminate hazards of slot wear and corrosion. Any desired edge available. Write for Bulletin EDJ-1094.

Complete ONE-PIECE assembly to fit shell of any Jordan

E.D. Jones FULBAR SHELL FILLINGS

Ideal filling for any Jordan, new or old, of any make. No keys or wedges needed. Easy to grind in. Many other advantages. Write for Bulletin EDJ-1094.

E. D. JONES & SONS COMPANY

Pittsfield, Massachusetts

Builders of Quality Stock Preparation Machinery

In Canada: The Alexander Fleck, Ltd., Ottawa

PRICES OF FIBERS

MARKET WOOD PULP

FIRST QUARTER CONTRACT PRICES PER SHORT AIR-DRY TON

Delivered Basis

	U.S.	Canadian	Swedish	Finnish	Norwegian
Groundwood	$82.50/ 90.00	$82.50/ 90.00	§$90.00/ —	§$90.00/ —	§$90.00/ —
Bleached Gw'd.	$97.50/100.00	$97.50/100.00			
Kraft, Blchd.	157.00/ —	160.00/162.50	$157.00/162.50*		$157.50/ —
Kraft, Blchd. Hdwd.	152.00/ —		$137.00/ —		
Kraft, Semi-bleached	140.00/ —	140.00/ —			
Kraft, Unbl.	117.50/125.00	125.00/130.00	†125.00/130.00	125.00/ —	
Sulphite, Blchd.	155.00/ —	155.00/ —	*155.00/ —	*155.00/ —	155.00 —
Sulphite Bl. Hdwd.	150.00/ —				
Sulphite, Unblchd.	135.00/ —	135.00/ —	†135.00/ —	*130.00/ —	
Sulphite, Unb'l. Gl'sn		134.00/ —	†134.00/ —		
Soda, Blchd.	147.00/150.00	150.00/ —			

§ On Dock Atlantic Ports. * Freight allowed. † Varying Freight Allowances

NEW YORK RAG MARKET

New Domestic Cotton Cuttings

Delivered Mill Basis

PRICES NOMINAL

	Per 100 lbs.
No. 1 White Shirts	$13.50/$14.00
No. 1 Unblchd. Muslins	16.00/ 16.50
Blchd. & Unblchd. Underwears	15.00/ 15.50
No. 1 Light Silesias	7.00/ 7.50
No. 1 Light Blue Overalls	7.25/ 8.00
Percales	6.00/ 6.50
No. 1 Light Prints	5.00/ 5.25
Suntan Khakis	5.50/ 6.00
Cottonades	3.25/ 3.75
No. 1 Washables	2.50/ 2.75

Old Domestic Cotton Rags

(Prices to Dealers, f.o.b. Ship. Pt.)

	Per 100 lbs.
Mixed White	$3.00/$3.25
Cotton Pants & Overalls	2.00/ 2.25
Twos and Blues, Repacked	1.50/ 1.75
No. 2 Roofing	

COTTON LINTERS

Memphis Market

f.o.b. Oilmills

Week Ended January 6	For 100 lbs.
Grade 1 n.a.	
2	$9.50/ $9.25
3 1 cut—felting	8.50/ 8.00
4	7.75/ 7.00
5	6.75/ 6.25
6	6.00/ 5.50
7	5.25/ 5.00

*Based on 73% cellulose.

Old Rope & Bagging

(Prices to Dealers, f.o.b. N.Y.)

	Per 100 lbs.
New Burlap Cuts (soft)	$6.00/$6.50
Scrap Burlap	
Australian Wool Pouches	5.00/ 5.37
Gunny	4.75/ 5.00
No. 1 Domestic Manila Rope	7.75/ 8.25
No. 1 Foreign Manila Rope	6.25/ 6.50
Domestic Sisal Strings	

WASTE PAPER MARKET

Mill Prices, f.o.b. Trucks Shipping Point — Includes Brokerage

These quotations are a partial indication of the price range on volume tonnage in each market on the date specified, as gathered from major dealers. SPECIAL PACKINGS AND SPOT TONNAGE NOT INCLUDED. Prices nominal.

	New York	Boston	Chicago	Los Angeles
	January 6	January 6	January 6	January 6
No. 1 Mixed Paper	$4.00/ 6.00	5.00/ 7.00	4.00/ —	12.00/ —
No. 1 News	13.00/ 15.00	14.00/ —	14.00/ —	12.00/ —
Overissue News (Lg. size)	16.00/ 18.00	12.00/ 14.00	19.00/ —	16.00/ —
Mill Wrappers	11.00/ 13.00	12.00/ 14.00	7.00/ —	13.00/ —
Old Corrugated Containers	21.00/ 22.00	20.50/ 21.00	22.00/ —	20.00/ —
Super Resorted Kraft Paper	30.00/ 35.00	35.00/ 42.50	35.00/ —	45.00/ —
New Double Kr. Ld. Corr. Cuts	25.00/ 30.00	35.00/ 37.00	35.00/ —	30.00/ —
(Semi-chem. medium)	45.00/ 50.00	42.50/ 47.50	45.00/ 50.00	35.00/ 45.00
New 100% Kraft Corr. Cuts	50.00/ 55.00	50.00/ 55.00	55.00/ —	40.00/ —
New Br. Kraft, Env. Cuts	65.00/ 70.00	70.00/ 75.00	55.00/ —	45.00/ 50.00
New Br. Kr. Bag Waste Prntd.	55.00/ 60.00	55.00/ 60.00	50.00/ —	45.00/ 50.00
New Br. Kr. Bag Waste Unprintd	60.00/ 65.00	65.00/ 75.00	65.00/ —	45.00/ 50.00
No. 1 Groundwood Shvs.	25.00/ 30.00	24.00/ 30.00	16.00/ —	25.00/ 30.00
White Newsblanks	50.00/ 55.00	52.50/ 57.50	40.00/ —	55.00/ —
No. 1 Soft White Shvs.	55.00/ 60.00	60.00/ 65.00	60.00/ —	— / —
Super Soft White Shvs.	65.00/ 75.00	75.00/ 85.00	70.00/ —	— / —
Hd. White Shvs.	90.00/ 95.00	100.00/110.00	90.00/ —	85.00/ 90.00
Hd. White Env. Cuts	115.00/125.00	120.00/130.00	100.00/ —	100.00/110.00
Col. Tab. Cards	50.00/ 60.00	55.00/ 62.00	47.50/ —	42.50/ —
Manila Tab. Cards	60.00/ 70.00	70.00/ 75.00	65.00/ —	75.00/ —
No. 1 Col. Ledger	28.00/ 33.00	30.00/ 35.00	40.00/ —	22.50/ —
White Ledger	45.00/ 50.00	50.00/ 55.00	52.50/ —	35.00/ —
Mixed Book & Mag.†	18.00/ 19.00	19.00/ 20.00	12.00/ —	— / —
No. 1 Books‡	25.00/ 27.00	22.00/ 24.00	27.50/ —	— / —

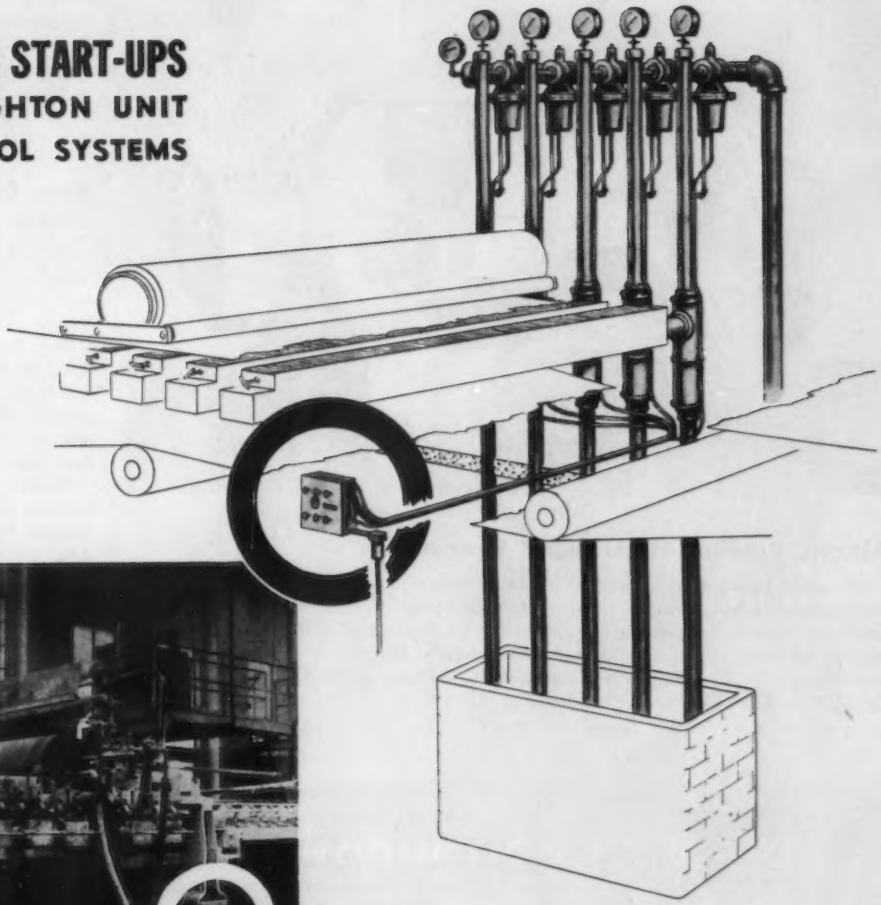
† Includes Time & Life; no coarse groundwood. ‡ Not to exceed 10% of groundwood.

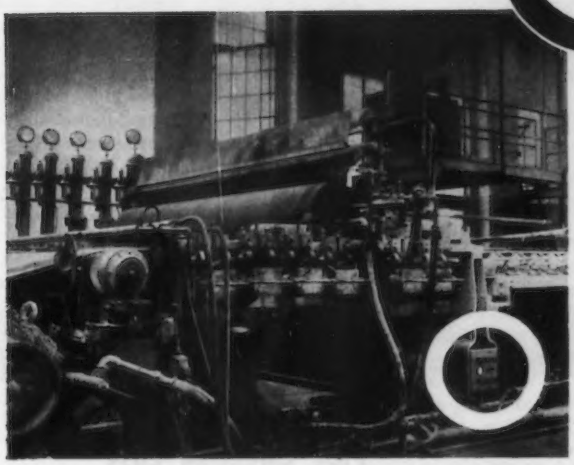
PRICES OF MATERIALS

Aluminum sulphate:			
coml. bulk, c.l. wks.	cwt.	2.00	/ —
iron-free, c.l. wks.	cwt.	3.55	/ —
Casein, acid prec.:			
dom. sh. pt. c.l. (30 mesh)	cwt.	56.00	/ —
Arg. ex. dock	cwt.	20.75	/21.50
New Zealand	cwt.	24.00	/25.00
Caustic soda:			
c.l. wks. solid, 76%	cwt.	4.30	/ —
flak. & grd. drums, c.l.	cwt.	4.70	/ —
liquid 50% tanks		2.90	/ 3.00
liquid 73% tanks		3.00	/ —
China Clay			
dom., dry-grd., airfloat:			
325 mesh bgs., c.l. Geo.	ton	10.00	/ —
300 mesh, bgs., c.l. Geo.	ton	13.50	/14.50
imp., white, lump, c.l. ex. dock		20.00	/35.00
Chlorine:			
single-unit tanks, works	cwt.	3.15	/ —
multiple unit, 2-5 cars per yr.		5.25	/ 4.05
Lime:			
hydrated, bulk, c.l. N.Y.	ton	23.63	/ —
quicklime, bulk, c.l. N.Y.	ton	22.13	/ —
Gum rosin:			
K, M, N, drums, c.l. Savan,	cwt.	7.40	/ 7.92
Rosin size:			
70%, gum & pale paste, tank cars, south, sh. pt.	cwt.	7.38	/ 7.48
Saltcake:			
dom. bulk, 100% anh. wks.	ton	28.00	/ —
Soda ash:			
light, 58% ash bags, wks.	cwt.	1.85	/ —
bulk, c.l. wks.	cwt.	1.60	/ —
Sodium chlorate:			
drums, c.l., wks.	cwt.	9.00	/ —
drums, l.c.l., wks.	cwt.	9.50	/10.50
Sodium peroxide:			
dms., c.l. E. of Miss.	lb.	.20½	/ —
l.c.l. (same basis)		.21	/ .21½
Sodium silicate, 40° Be.:			
tank-cars, wks.	cwt.	1.20	/ —
drums, c.l. wks.	cwt.	1.55	/ —
47° Be. WW.			
tank-cars, c.l. wks.	cwt.	1.90	/ —
drums, c.l. wks.	cwt.	2.25	/ —
Soybean, protein:			
chem. isol., wks. c.l. bags	lb.	.23	/ —
Starches:			
Corn, multiwalls, c.l. prod. plant:			
pearl	cwt.	6.49	/ 6.75
white, dextrins	cwt.	8.08	/ 8.20
chlorinated	cwt.	8.25	/ 8.35
potato, Idaho, c.l. wks.	cwt.	6.50	/ —
East, fr. all. 50 cents cwt.			
potato, Maine, f.o.b. wks.	cwt.	6.25	/ —
Sulphuric acid:			
60° Be. cbys. c.l. wks.	cwt.	2.00	/ —
l.c.l. wks.	cwt.	2.45	/ —
tank-cars, wks.	ton	18.60	/ —
Sulphur:			
crude, c.l. mines, contract, long	ton	23.50	/ —
f.o.b. vessels Gulf dock	ton	25.00	/ —
Sulphur dioxide:			
liquid, coml. cyl., wks.	lb.	.10	/ .12
multi-unit cars, wks.	lb.	.0535/	—
Talc, fibrous grd., bags:			
c.l. wks., N.Y.	ton	28.00	/ —
l.c.l. wks., N.Y.	ton	31.00	/36.00
Titanium dioxide:			
anstase, c.l. dlvd. E. bags	lb.	.25½	/ —
l.c.l. dlvd.	lb.	.26½	/ —
rutile, c.l. dlvd.	lb.	.27½	/ —
l.c.l. dlvd.	lb.	.28½	/ —

NOW- REMOTE PNEUMATIC CONTROL
of individual flat box vacuums!

QUICKER, EASIER START-UPS
with the BROUGHTON UNIT VACUUM CONTROL SYSTEMS





This system permits instant, accurate adjustment of individual box vacuums from any desired location and usually eliminates the flat box vacuum pump.

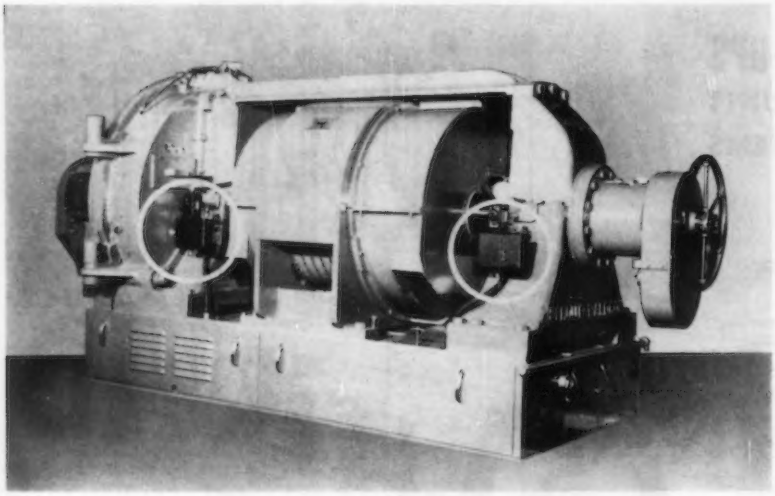
Phone Collect Glens Falls, N. Y. 2-6541 for full information.

BROUGHTON
SYSTEMS FOR PAPER MACHINES

A.E.BROUGHTON & COMPANY

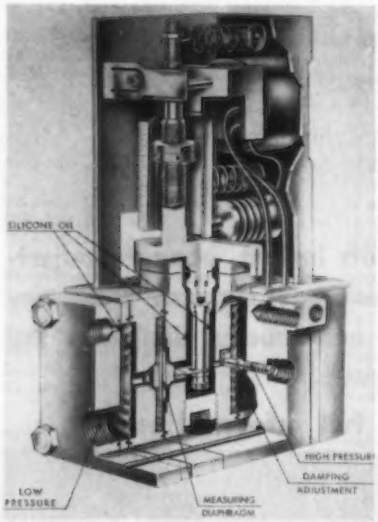
GLENS FALLS, NEW YORK CABLE ADDRESS: BROUGHTCO TEL. 2-6541

NEW EQUIPMENT AND SUPPLIES



Alarms Protect High-Speed Bearings

High speed bearings of a Sprout, Waldron refiner are protected by interlocking the motor starter controls with Fischer & Porter Ratosight Alarms (circled). Operator cannot start the refiner unless the lubricating oil is flowing to the bearings. If oil flow stops, the alarms automatically shut down the refiner before bearings overheat and become permanently damaged. Write Fischer & Porter Co., 459 Jacksonville Road, Hatboro, Pa.



Calibration Stability with New D/p Transmitter

Fischer & Porter's new force-balance differential pressure transmitter features a measuring circuit completely immersed in silicone oil. The new design is said to reduce maintenance and keeps extraneous forces out of the force balance circuit, yet provides rapid response to differential pressure changes.

Range changes are easily made and zero adjustment is external. The new transmitter operates up to 1500 p.s.i.g. working pressure with complete overrange protection. Calibration stability under changing temperature or pressure conditions is exceptional. The all-metal transmitter is furnished with a corrosion-proof fiber glass cover.

For more information, write Fischer & Porter Co., 457 Jacksonville Road, Hatboro, Pa.

Corrosion-Resistant Pipe in Small Sizes

A new, highly corrosion-resistant pipe made of cost-cutting integrally bonded clad steel has become possible in diameters as small as four inches through advances in welding techniques just announced by the Lukens Steel Co.

Lukens unveiled, at the 26th Exposition of the Chemical Industries in New York, a sample length of small-diameter pipe whose inside surface is a layer of solid stainless steel, completely and permanently bonded to a heavier outer layer of carbon steel.

Keys to the advance are new economical techniques by which clad pipe can be fabricated and joined while still preserving the integrity of the vital inner layer of stainless. These techniques were developed by Lukens and the Youngstown Welding & Engineering Co., manufacturer of the sample pipe introduced at the exposition.

The new pipe is said to give all the benefits of solid stainless at a cost below that of comparable solid stainless.

New Ductile Iron Steam Traps

A new line of ductile iron steam traps said to cost less than comparable cast steel traps has been announced by Strong Steam Specialties Division of Strong, Carlisle & Hammond. Known as the 540 Series Hydro-Flex Traps, this line is designed for service to 500 p.s.i. and 650°F., making it especially adaptable for use on process equipment where cast steel is normally required.

Ductile (nodular) iron, a recent metallurgical development will bend or twist without breaking under fire or explosion. Its strength, toughness and wear resistance is said to be comparable to steel. Ductile iron can be welded or brazed. ASME has adopted ductile (nodular) iron for use in vessels at pressures to 1000 p.s.i. and temperatures to 650°F. (80% of cast steel service).

The inverted bucket design of Strong traps incorporates a dual-fulcrum action of the valve lever which provides high discharge flow when required, yet permits efficient handling of very low condensate loads. The 540 Series traps are available in five standard sizes with pipe connections from ½ to 2 inch (screwed or socket weld), and discharge capacities to 42,800 pounds of water per hour.

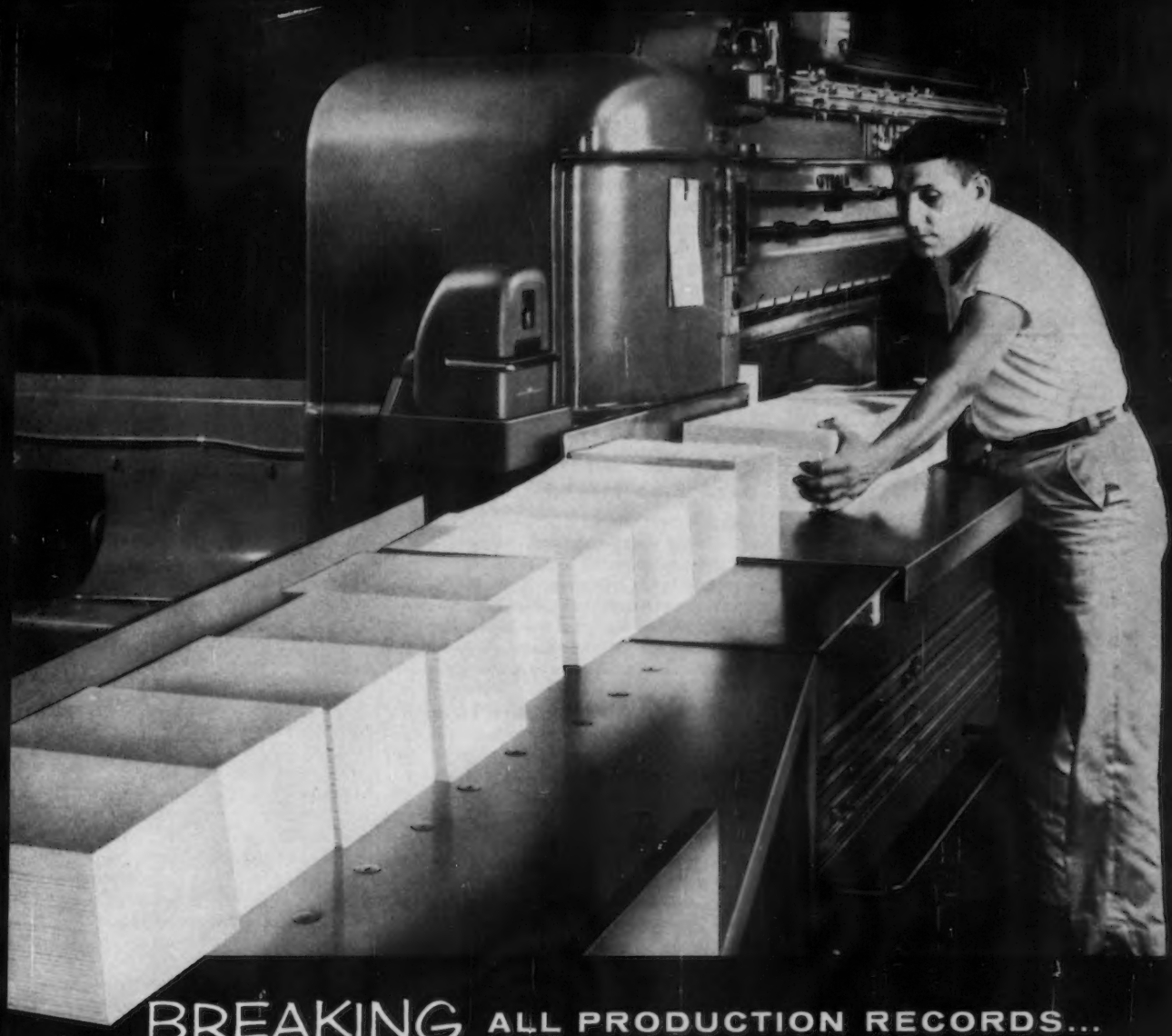
Portable Tool Makes Pipe Coupling Easy

Two new compact, portable tools that quickly roll grooves into lightweight pipe and tubing—without removing any metal—have been added to the line of pipe groovers developed by the Victaulic Company of America, Elizabeth, N. J.

Designated "Vic-Easy" Series 100 and Series 200, these portable tools for use on-the-job or in-the-shop are readily adjustable from 1¼ inch through 12 inch diameters. The tools make it easy for anyone to groove pipe ends for fast leak-tight jointing of water, oil, air or other lines with "Vic-Easy" snap-joint, standard or light weight couplings.

Although light in weight, the new

(Continued on page 50)



BREAKING ALL PRODUCTION RECORDS...

SEYBOLD 65", 85", AND 100" FULL-HYDRAULIC CUTTER-TRIMMERS

You're looking at one of the Seybold Full-Hydraulic cutter-trimmers that is setting new standards of production and accuracy in leading paper mills and commercial finishing departments throughout the country.

The reason? Operators from major mills spell it out like this:

- Full-hydraulic control of knife bar, clamp and back gauge is the smoothest, fastest cutting combination ever.
- Seybold exclusive Auto-Spacer positions precisely every time, permits full concentration on loading, cutting, and unloading.
- Air-film table takes the backbreak out of paper handling, reduces fatigue, boosts production.
- New table-slot closing device multiplies advantages of backloading, permits uninterrupted work flow.

These are only a few of the reasons. Call your Harris-Seybold representative for the full story. Ask to see the Seybold Full-Hydraulic story—"Accuracy by the Carload"—our fast-moving, 18-minute color film. You owe it to your competitive position.

HARRIS INTERTYPE CORPORATION

HARRIS-SEYBOLD

A Division of Harris-Intertype Corporation
4510 East 71st Street, Cleveland 5, Ohio, U.S.A.

(Continued from page 48)

"Vic-Easy" portable tools roll perfect grooves into pipe in seconds, using only a fraction of the time and labor needed to conventionally thread pipe. The user simply sets the pipe between forming rolls, with pipe end against pipe stop, and turns down the roller feed screw to proper groove depth. There is no need to measure or gauge dimensions. Operation is either manual — stroking the ratchet handle — or power-operated from power vise, pipe machine, winch or hub drive of field trucks, etc.

Submersible Pumps for Deep Well Installation

A new line of six-inch diameter submersible pumps has been placed in production by F. E. Myers & Bro. Co., 249 Orange St., Ashland, Ohio.

The new line of heavy duty submersible units are particularly suitable for deep well installations where large volumes of water are needed. The pump can be installed in wells as deep as 700 feet. The line's top capacity at a 50-foot depth is over 13,000 gallons of water an hour.

Called the "SC" submersible pump, units are available for providing primary water supply for industrial plants and other commercial buildings, or as a booster system for increasing pressure in water lines.

The Myers "SC" submersible operates completely under water and is a combined pump and motor unit. The 60 cycle motor is oil lubricated, sealed, and drives the pump through a rigid coupling. Power is supplied to the submerged motor by a waterproof cable that is attached to the riser column pipe. The pump is available in 5, 7½, 10 and 15 horsepower sizes.

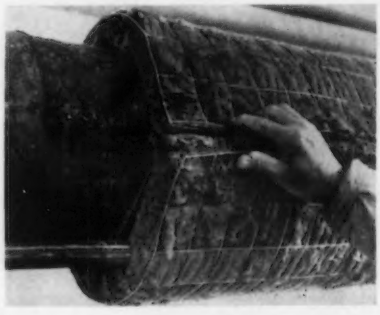
The pump unit is a multi-stage centrifugal turbine pump and is made in either flat pancake stages for lower capacities at high head, and a turbine bowl type construction for higher capacities at lower heads. The impellers on the new Myers submersibles are bronze and of the enclosed type.

Built-in Tie Wires Speed Pipe Insulation

Development of No. 101 pipe insulation, a new speed-fastening, high-temperature pipe covering is announced by Baldwin-Hill Co., Trenton, N. J. Built-in tie wires eliminate the need for conventional tie wires so that the insulation can be applied to large diameter lines as rapidly as more costly molded pipe coverings.

Specially felted from high-temperature, moisture-resistant spun mineral wool, B-H No. 101 pipe insulation, will withstand temperatures to 1200 F. Its exterior surface is faced with a metal fabric of 16-ga. wires welded in a 2 x 2⅝-in. rectangular mesh and held in place by 16-ga. wires tied through the spun wool to an inner facing of one inch expanded metal lath. Speed fastening on the pipe is accomplished, as shown in the photograph, by hooking seven wires which extend from one end of the outer mesh fabric under the opposite stay wire and bending them over and back.

No. 101 pipe insulation is especially well suited for covering nested pipes and steam traced lines (see photo) since it



can be manufactured to fit exactly. It is available in 2-ft. sections and 1½- to 4-in. thicknesses for pipe sizes from 4 to 30 in.

For additional information, write Engineering Dept., Baldwin-Hill Co., 500 Breunig Ave., Trenton, N. J.

Advances in Weight Printing

Advances in weight recording equipment for industry are announced by Toledo Scale in the new Printweigh "400" series. These include a new

"memory" feature as well as a greater versatility in recording both at the scale and remotely.

Toledo's new scale, it is stated, offer the printing of weight data in clear figures anywhere on office forms or tickets up to 8½ x 11 inches in size; full identity of these weights including time and date; and also transmission of weight data in digital form to remotely located office machines such as adding machines and tabulator tape punches.

These new weight-printing scales have a "memory", and will record at the scale, or transmit a weight figure to a remote location even after the load is removed from the platform. Another load can be placed on the platform without affecting the stored data. This flexibility gives new speed to weighing operations.

With the new Toledo Printweigh "400" series a complete weight figure always is printed even when unit weights, which increase dial capacity, are used. Weights can be fully identified by selective numbers, which are available in keyboards with from six to as many as twelve banks. If symbols or names are preferable, provision can be made for up to ten.

It is stated by Toledo Scale that the new series will be in production in the first quarter of 1958 and will be offered in a full range of capacities from bench and portable scales to motor truck scales. Literature describing the new Printweigh "400" series is available and may be requested from Toledo Scale, division of Toledo Scale Corp. Toledo 13, Ohio.

WITH THE

IMPCO PRESS BROKE SHREDDER

Now, your press broke can be automatically shredded and slushed to the couch pit at pumpable consistence. Completely proven in a wide range of tonnages, the unit used in the above illustration is in service on a 500 T/D kraft machine at 2500 f.p.m. at 32%.

Let us show you how this principle can be applied in your existing mill.

IMPROVED MACHINERY INC.
NASHUA • NEW HAMPSHIRE

In Canada, Sherbrooke Machineries Limited, Sherbrooke, Quebec

DU PONT
REG. U.S. PAT. OFF.
BETTER THINGS FOR BETTER LIVING
. . . THROUGH CHEMISTRY

GRASSELLI CHEMICAL BRIEFS

for the Paper Industry

CONTAINER COATINGS based on "Ludox" increase surface friction . . . make multiwall paper bags and corrugated cartons safer and better-looking at a nominal cost.

Ludox® gives smooth paper containers excellent anti-slip characteristics

There are many ways to increase the coefficient of friction for paper. But increasing friction while improving the paper's neat appearance and printing properties calls for a very special coating material.

That special material is "Ludox" colloidal silica, a versatile Du Pont chemical. Coatings of "Ludox" give containers high skid resistance and a neat, attractive look.

The secret of this effectiveness is the ability of "Ludox" to increase surface friction *without destroying the paper's smoothness*. The submicroscopic particles of colloidal silica are so fine there's hardly any difference to the touch—yet in contact with another surface containing "Ludox," these particles engage one another to prevent skidding.

Coatings of "Ludox" can be applied in several ways. Some multiwall paper bag makers apply the coating in the final stages of manufacture; others apply it during the machine stage before the bags are formed. Still others spray on the "Ludox".

Here's more news! A manufacturer of corrugated cartons coats "Ludox" on the top and bottom flaps of boxes where slip resistance is needed. Results with "Ludox" coatings have been excellent.

NEW BROCHURE OUTLINES PRODUCT IMPROVEMENTS AND NEW PROFIT OPPORTUNITIES

Paper bags that resist slipping . . . containers held fast by weatherproof adhesives . . . paper that is flame- and moisture-resistant. These examples of how Du Pont Grasselli chemicals are helping improve the quality of paper and paper products are described in a new brochure—Chemicals for the Pulp and Paper Industry. Learn how you can use them to advantage in your mill. Write for free copy today. E. I. du Pont de Nemours & Co. (Inc.), Grasselli Chemicals Dept., Room N-2533, Wilmington 98, Del.

QUILON® STOPS GREASE CRAWL ON VEGETABLE PARCHMENT FOR PACKAGING

Here's a way to make vegetable parchment papers more versatile. Treat them with Du Pont "Quilon" chrome complex to make them grease-resistant. They'll be ideal for lightweight commercial wrapping and packaging applications.

"Quilon" not only inhibits grease crawl, but also greatly reduces penetration and staining. "Quilon" adds water repellency and release properties to the high wet strength of vegetable parchment. The treatment is easy and economical to apply and does not affect the other properties of paper.

ONE-STEP PROCESS MAKES PAPER RESIST FLAME AND WATER

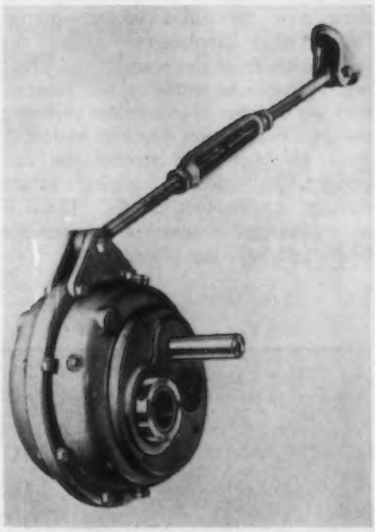
Du Pont has developed a simple, one-step process to help paper combat the effects of fire and water. "Quilon" chrome complex, a water repellent, and a flame retardant based on ammonium sulfamate are applied to paper from a single bath at the size press, from a coater, or with other surface-treating equipment.

The technique is effective and economical. No time is lost, no extra equipment or labor is needed. The process can be used to improve papers for paper draperies, decorative papers, tablecloths and many other end uses.

Shaft Mounted Gear Reducer Ends Alignment Problem

A shaft mounted gear reducer that eliminates need for motor bases, rails, supporting structures and flexible couplings is now available from Lovejoy Flexible Coupling Co., 4999 W. Lake St., Chicago 44, Ill. It provides a compact, space-saving power transmission unit for countless industrial applications. The reducer also eliminates alignment problems and makes possible infinite speed ratios through the use of variable speed pulleys or by changing sheaves, sprockets or prime mover speed. Proper belt tension between drive and driven unit is maintained by simple adjustment of the rod and turnbuckle.

Eighteen models, including single and double reduction types, can be supplied from stock. Single reduction types are 98 per cent efficient and afford 4.5:1 speed ratio (nominal). Double reduction types are 96 per cent efficient and afford 14.7:1 speed ratio (nominal). Horsepowers range from fractional to 120, output speeds from 8 to 425 r.p.m.



The reducer is easily installed direct to driven shaft and can be mounted vertically or at any angle.

Semi-Automatic Open Arc Hard Surfacing Welder

Alloy Rods Co., a manufacturer of alloy welding electrodes, made its entry into the equipment field recently with the introduction of a wire feed unit for semi-automatic open arc hard surfacing. The new semi-automatic welder will be sold under the trade name "Wear-O-Matic" wire feed unit. For use with the welder, the company also announced a new line of Wear-O-Matic open arc 7/64" diameter hard surfacing wires.

The Wear-O-Matic wire feed unit is said to allow quicker, easier set-up; faster wire change-over and a greater degree of portability. The unit is designed to use Wear-O-Matic wires supplied in convenient packages. Thus, the wire supply is separate from the unit which weighs only 70 pounds, making portability from job to job a one man operation. The unit will operate from nearly any d. c. power source and only two electrical connections are required.

For complete details, request Bulletin AR-16 (90) Alloy Rods Co., P. O. Box 1828, York, Penna.

Fluorescent Inspection Locates Leaks

Now, a completely portable fluorescent penetrant inspection kit is available for locating cracks, pores, leaks and other defects open to the surface in any solid material. This kit, known as the Zyglo ZA-43, contains the most sensitive of the Zyglo materials—all in push-button, pressurized spray cans. Included in the kit's steel carrying case are: pressurized spray cans of cleaner, penetrant, and developer; a 100 watt high intensity Black Light; cleaning cloths; wire brush; and detailed instructions.

In testing with Zyglo, penetrant is sprayed on the surface of the part to be tested, and time is allowed for capillary action to draw the penetrant into any crack or porosity. Cleaner is then used to remove penetrant from the surface. By applying a thin film of spray-on developer, the fluorescent penetrant is drawn to the surface from any crack or pore. The portable, (115 volt) high intensity Black Light locates every defect as a glowing fluorescent indication.

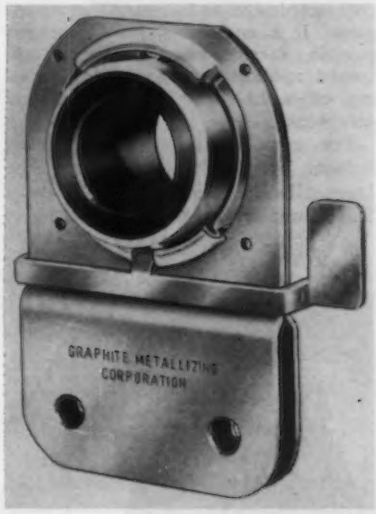
The kit may be used for maintenance work, overhaul tests, (especially of non-magnetic parts) or for small volume in-production testing of castings, forgings, machined parts, weldments, and carbide tools. Any thin walled casing, weld, or tank which must be leak proof in its final assembly may be inspected for leaks at any stage in its manufacture.

A descriptive folder may be obtained by writing to Magnaflux Corp., 7300 West Lawrence Ave., Chicago 31, Ill.

Hanger Bearing Assemblies For Conveyor Rolls

A complete new line of hanger bearing assemblies for industrial conveyor rolls is being manufactured by Graphite Metallizing Corp. Each assembly has a Graphalloy bushing, a composition that is actually a dry lubricant in itself, able to retain its properties over a wide range of temperatures. Graphalloy assemblies are used extensively in high temperature equipment such as dryer and oven conveyors . . . where oil and grease would volatilize and cause product contamination or a fire. They are particularly suitable for roller dryers. In these dryers Graphalloy bearings have operated for five and ten years without downtime or maintenance. They are also suited to sub-zero work, where liquid lubricants solidify.

Graphalloy bushings do not attract dirt or lint, and are thus free from their



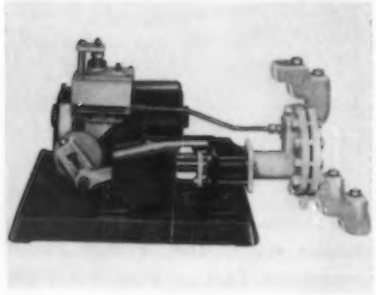
abrasive action. The bushings cannot contaminate food or pharmaceuticals, and can be used in water, gasoline, acids, dyes and other fluids. They do not swell or change dimension. Detailed information on the full line may be had by writing Graphite Metallizing Corp., Yonkers, N. Y.

Immersible Motor for Submerged Operation

The Louis Allis Co. recently announced a new immersible motor for submerged operation. The unit is designed for close-coupling to agitators or pumps in sewage sumps, chemicals, and water. In pump applications this flange-mounted motor eliminates many connecting components such as intermediate bearings, couplings, shafting, special bases, etc., since the motor shaft is directly attached to the impeller. Motor and pump can be raised and lowered into position together by means of the motor's lifting lugs.

Features include leak-tight construction, neoprene breathers, oil-filled at factory, waterproof cable connection, compact design and corrosion resistant parts. It is engineered for submerged pumping service, mixers, agitators and special applications. Available in ratings of ¾ to 40 h.p., both single and polyphase.

For complete information, request bulletin No. 2300 directly from The Louis Allis Co., Dept. P, 427 E. Stewart St., Milwaukee 1, Wis.



Diaphragm Prevents Leaks from Metering Pumps

For metering toxic, obnoxious, corrosive and/or costly chemicals, Milton Roy Co., has introduced a new controlled volume diaphragm pump. Retaining features of Milton Roy standard line with which it is interchangeable, these new controlled volume pumps have Teflon diaphragms sealing the liquid ends from the plunger and housing. Accurate to within ± one percent, they are positive displacement metering pumps. The plunger displaces hydraulic fluid which in turn strokes the diaphragm to impart pumping action through double ball checks. There is no mechanical connection between the diaphragm and the plunger.

Available with maximum capacities from 1.1 to 138 gallons per hour and pressures to 2000 pounds per square inch, these new diaphragm pumps have manual or automatic capacity adjustments from 0 to 100 per cent. With automatic capacity adjustments, they are vital to chemical instrumentation systems.

Details and specifications on controlled volume diaphragm pumps are available from Milton Roy Company, 1300 E. Mermaid Lane, Philadelphia 18, Pa.

Figures of the Week

PAPER PRODUCTION RATIO REPORT—American Paper & Pulp Assn. Figures

(Production as percent of normal capacity)

COMPARATIVE WEEKLY SUMMARIES

1957	Nov. 30 86.0	Dec. 7 90.6	Dec. 14 91.2	Dec. 21 92.0r	Dec. 28 51.2
1956	Dec. 1 98.6	Dec. 8 99.3	Dec. 15 98.4	Dec. 22 99.3	Dec. 29 66.7

r Revised.

COMPARATIVE MONTHLY SUMMARIES

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year Avg.
1957	94.2	97.0	97.1	94.0	94.6	93.3	75.6	90.5‡	85.8‡	92.4‡	89.8‡		
1956	99.6	102.6	102.9	102.5	101.8	99.9	85.6	96.7	94.3	99.5	97.6	90.9	97.9

‡ Preliminary.

COMPARATIVE YEARLY SUMMARIES

	1950	1951	1952	1953	1954	1955	1956	1957
Year to Date	96.2	99.2	90.2	93.2	92.1	95.6	98.5	91.1
Year Average	95.8	98.0	88.6	92.3	91.6	94.9	97.9	

All of the above data is based on tonnage reported to American Paper and Pulp Association. Does not include mills reporting to National Paperboard Association, except in isolated cases where both paper and paperboard are produced and separate tonnage figures are not readily available. Does not include mills producing newsprint exclusively.

PAPERBOARD OPERATING RATIOS†

COMPARATIVE WEEKLY SUMMARIES

1957	Nov. 23 94	Nov. 30 86	Dec. 7 84	Dec. 14 92	Dec. 21 93
1956	Nov. 24 89	Dec. 1 86	Dec. 8 95	Dec. 15 95	Dec. 22 96

COMPARATIVE MONTHLY SUMMARIES

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year Avg.
1957	91	94	94	92	93	91	72	94	91	97	92		
1956	100	100	99	100	99	98	77	95	89	96	93	84	94

† *Percents of operation based on "Inch-Hours" reported on a 6-day basis to the National Paperboard Association.*

SUMMARY OF PAPERBOARD STATISTICS—National Paperboard Assn. Figures

ITEM	THIS WEEK ENDING Dec. 21, 1957	LAST WEEK ENDING Dec. 14, 1957	CUMULATIVE TO DATE Jan. 1 to Dec. 21, 1957
% Activity	93%	92%	92%
	Tons	*Tons*	*Tons*
Total Production	290,705	288,876	13,961,230
Liner	98,062	97,309	4,820,607
Corrugating Material	43,585	45,387	2,140,916
Chip & Filler Board	4,869	4,369	277,120
Total Containerboard	146,516	147,065	7,238,643
Folding	53,414	50,884	2,546,192
Set-Up	9,782	10,152	563,274
Special Food Board	24,660	24,150	1,204,148
Other	56,333	56,625	2,408,973
Total Boxboard	144,189	141,811	6,722,587
Total Orders	*Tons*	*Tons*	
Received	206,345	254,413	
Unfilled End of Week	276,494	368,256	

BRIEFS for buyers of

Caustic Soda
Sodium Chlorate

Some tips on supply logistics

Like all Hooker plants, this one in Montague, Michigan, is near deep water for a purpose—a purpose you might consider when choosing a supplier.

The water gives our customers the option of barge as well as rail delivery.

For many, the barge service means cheaper delivery. For others, it offers an alternative means of shipment in case of interruption in rail service.

Here are three other "pluses" to consider when you select a chlorine-caustic supplier. (As a Hooker customer, you enjoy all of them):

1. Competent engineering help. An experienced supplier can give you assistance in designing or revamping your chlorine or caustic soda handling system.

2. Operating assistance. Your supplier's technical servicemen can often spot—and help you correct—operating troubles before they become serious. Do you get the advantage of periodic technical service visits?

3. Safety programs. Your supplier should be able to give you up-to-date advice on safe equipment and handling methods.

We'll be glad to enlarge on these points, with your requirements in mind. Simply phone or write the nearest Hooker sales office.

Chlorine dioxide bleaching

Are you taking advantage of the high brightness—high paper strength you get with chlorine dioxide?

If so, you'll be interested in what we are doing to insure good supply of *sodium chlorate*—the chemical "raw material" you need for this fast-growing new bleaching method.

Thanks to our plants at Niagara Falls, N. Y., and Columbus, Miss., we are currently the nation's largest producer of sodium chlorate. But even that isn't good enough to meet *tomorrow's* needs.

The Columbus plant has been in production since 1954. Last summer we upped its capacity by 5,000 tons/yr. Now we're building again. By early 1958, another 5,000 tons/yr. will be on tap.

All this is by way of backdrop to four points you'll do well to consider when deciding where *you'll* go for sodium chlorate. Your purchase of Oldbury® sodium chlorate gives you:

1. Fastest service you can get in East and South, from our two plants.
2. Skilled technical help when you need it, *regardless of the process you use.*
3. Sodium chlorate that's of 99% minimum purity.
4. Over 50 years' experience in serving —and growing with—the pulp and paper industry.

May we spell out for you how this kind of service helps insure successful chlorine dioxide bleaching? For details, just write.

New booklet, pocket size, offers useful facts on buying caustic soda.

Besides information on forms, grades, and shipping containers, contents include a factual discussion on 50% *vs.* 73% liquid caustic, and a handy nomograph to help you figure which strength is your better buy.

There's also a nomograph to help you estimate your requirements for various process solutions.

Check the coupon for a copy.

Check items you'd like to receive:

- ☐ *Caustic Soda Buyer's Guide* booklet
- ☐ Technical data on caustic soda
- ☐ Technical data on sodium chlorate

For information on these other Hooker chemicals used in the pulp and paper industry, check below:

- ☐ Muriatic Acid
- ☐ Sodium Sulfide
- ☐ Sodium Sulfhydrate

Clip and mail to us with your name, title, company address.

HOOKER CHEMICALS PLASTICS

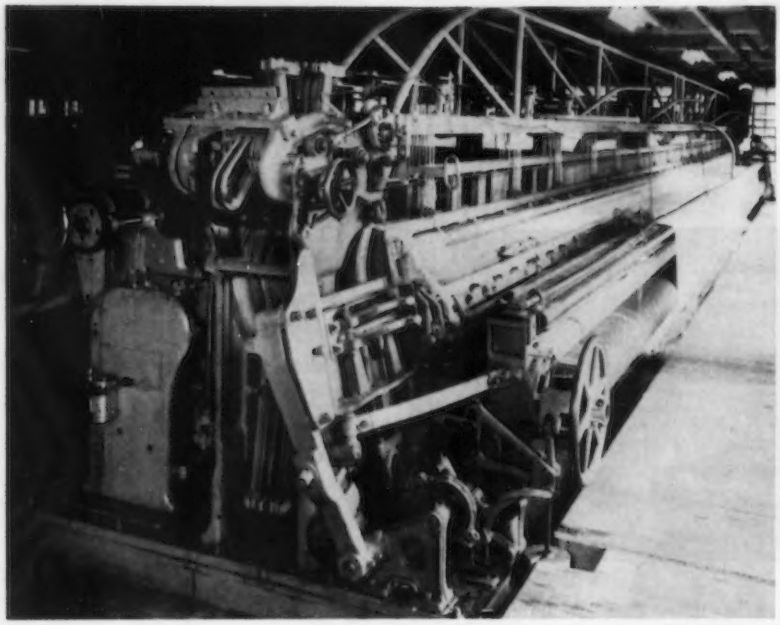
HOOKER ELECTROCHEMICAL COMPANY

1801 FORTY-SEVENTH STREET, NIAGARA FALLS, N. Y.

Niagara Falls Tacoma Montague, Mich. New York Chicago
Los Angeles Philadelphia Worcester, Mass.
In Canada: Hooker Chemicals Limited, North Vancouver, B. C.

NEWS OF

SUPPLIERS



Widest Felt Loom

Reported to be approximately six and a half feet wider than any other felt loom in America, is this giant loom recently installed by Shuler & Benninghofen, Hamilton, Ohio, producers of Hamilton felts, now celebrating its 100th anniversary.

D. H. Nelson

W. D. Willetts

Becco Chemical Division, Food Machinery and Chemical Corp., Buffalo, N. Y. has promoted Dewey H. Nelson to assistant manager. He will continue in the capacity of sales manager, a position he has held since November, 1956.

Albany Felt Co., Albany, N. Y. has appointed Walter D. Willetts sales engineer for the states of Florida, Georgia, South Carolina and part of Alabama, with headquarters in Jacksonville, Fla.

Mr. Willetts joined the concern in 1949 as a trainee. Since 1957, as a service engineer, he has worked closely with paper mills throughout the country and in South America.

Yale & Towne Manufacturing Co. has announced the appointment of Freeman Materials Handling Co. as franchise representative for the sales and service of Yale industrial lift trucks in the Toledo, Ohio area.

The territory covered by the new company will include the Ohio counties of Williams, Fulton, Lucas, Ottawa, Wood, Henry, Defiance, Paulding, Putnam, Hancock, Sandusky, Seneca, Crawford, Wyandotte, Hardin, Allen and Van Wert and the counties of Hillsdale, Lanawee and Monroe in Michigan.

A. E. Staley Manufacturing Co. has announced new assignments for four industrial sales people. Transferred to Staley's Chicago office as assistant manager is George A. T. Moore, who had been assistant manager at the company's Philadelphia office. Promoted to assistant manager of the St. Louis office is Al W. Brunlieb, who had been a sales representative in Wisconsin, under direction of the Chicago office. Transferred to the Philadelphia office as sales representative is James F. Kelly, who had been in the Minnesota, North and South Dakota territory under direction of the Kansas City office. Transferred to the Chicago office area is Richard L. Kamins, who had been assigned to the Boston office. He will headquarter in Madison, Wis., and will cover the Minnesota, North and South Dakota territory in addition to Wisconsin.

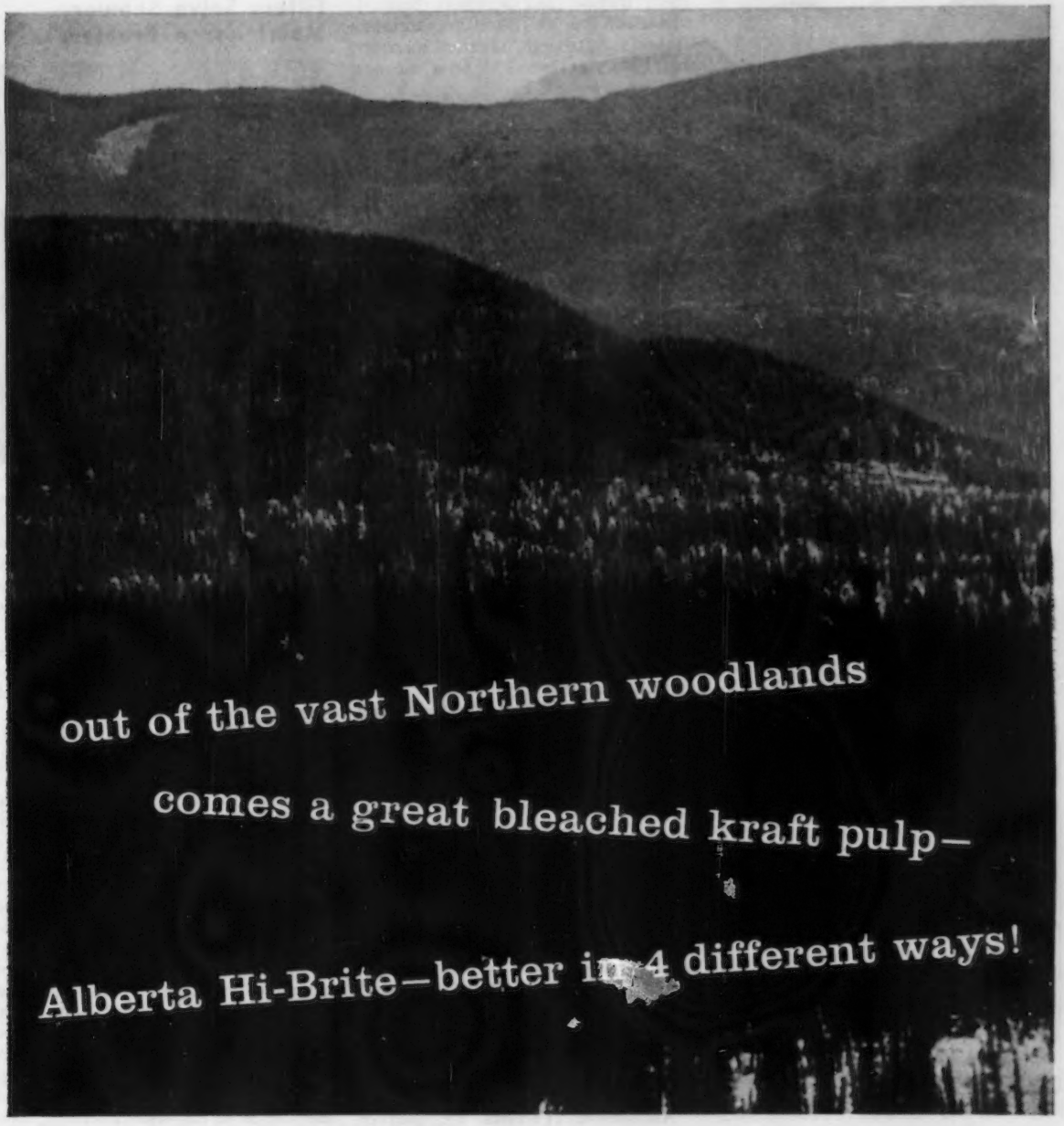
Morningstar, Nicol Inc., producer of starch and chemical products for the paper, textile, food, packaging, pharmaceutical, and cosmetic industries, and its principal industrial adhesives manufacturing subsidiary, Paisley Products Inc., have been merged to form a single corporation, Morningstar-Paisley, Inc. Morningstar adopted the Nicol name in 1930, when it absorbed J. M. & J. S. Nicol Co.; Nicol is now one of the company's smaller divisions. Also absorbed into the new corporation are several subsidiaries including Haberland Mfg. Co. and Federal Adhesives Corp., both acquired last fall. Hayes Adhesive Co., Inc., St. Louis, Mo., and Aroostook Potato Products, Inc., of Houlton, Me., will continue as separate subsidiary corporations.

Allis-Chalmers Industries Group has assigned Thomas Buckley and D. E. Fenton as sales representatives to the Indianapolis and Youngstown districts, respectively.

Robert L. Wroe

Foxboro Co. has appointed Robert L. Wroe, formerly in charge of accessories promotion with the Foxboro Service and Repair Division, an instructor in the training center in Foxboro, Mass. He is currently furnishing bench instruction and lecturing on mechanical instruments, particularly in the temperature and pressure measurement fields.

His appointment brings to five the number of full-time staff members of the Training Center, enabling a greater degree of individual instruction in the various phases of industrial instrumentation.



1 Alberta Hi-Brite is made from the long thin fibers of spruce and lodgepole pine . . . fibers famous for producing the best quality bleached kraft pulp. It imparts to your paper an unusually high degree of *folding and tensile strength* along with outstanding opacity and cleanliness.

2 Alberta Hi-Brite is the one bleached kraft pulp which not only gives your paper strength, but also formation and printability —qualities usually associated *only* with low strength pulps.

3 The new multi-stage chlorine dioxide bleaching process, exclusive to Alberta Hi-Brite, provides your pulp with whiteness and brightness suitable for producing even the finest writing papers.

4 And most important—Alberta Hi-Brite has the unique ability to develop good characteristics *whether the paper you produce calls for light or extensive refining.*

For full details on how Alberta Hi-Brite can improve your product, write Dept. PTJ-158, St. Regis Paper Company, 150 East 42nd Street, New York 17, N. Y.

St. Regis (SR)
PAPER COMPANY
150 EAST 42ND STREET, NEW YORK 17, N. Y.
PULP PAPER PACKAGING PLASTICS

W. G. Sittmann

J. P. Melhado

V. L. Baltzell

Oakite Products, Inc., has established two new divisions in their nationwide field organization.

Rochester will be the headquarters of the new Upper New York State Division, which will comprise the technical field representatives and warehousing facilities now based in Albany, Utica, Syracuse, Binghamton, Elmira, Rochester, Buffalo, and Scranton, Pennsylvania. Walter G. Sittmann, formerly Oakite's Pittsburgh division manager, has been transferred to head the new division.

John P. Melhado, formerly a field representative in New York City, will replace Mr. Sittmann in Pittsburgh.

The new Mid South Division will consist of Oakite representatives in Cincinnati, Nashville, Little Rock, Knoxville, Louisville, Evansville, Jackson, Shreveport, Memphis, and New Orleans. Victor L. Baltzell, representative in Dallas for the past 15 years, has been appointed manager of the new division. He will make his headquarters in Louisville, Ky.

John W. Bolton & Sons, Inc.,Lawrence, Mass. has appointed William J. Fondow sales representative for the company and its Emerson Manufacturing Co. Division to cover Wisconsin, Michigan and part of Minnesota. He will work under Joseph M. Steiner Bolton-Emerson midwest regional sales manager.

H. K. Ferguson Co. has appointed Ralph W. Olmstead executive vice president. The board of directors, meeting at the company's headquarters in Cleveland, also appointed James R. Fraser as vice president, engineering, and William E. Hark as vice president, construction.

CHAS. T. MAIN, INC.

ENGINEERS

Process Studies, Design, Specifications and Construction Supervision

PULP AND PAPER MILLS

Steam, Hydraulic and Electrical Engineering
Reports, Consultation and Valuations

80 Federal Street • Boston 10, Mass.

Stadler Hurter

International Ltd.

Engineers • Designers • Consultants

Specializing since 1923 in all phases of design, modernization and expansion of pulp and paper mills from forest to finished product.

1501 St. Catherine St. W.
MONTREAL

New York . . . Mexico City

OBITUARIES

Leland K. Spink, 58, engineer in charge of flow measurement at Foxboro Co., died December 23 in Foxboro, Mass. He pioneered in calculating and coordinating flow data. Among his inventions are the square root planimeter, and slide rules for sizing control valves and orifices. He was also the author of several flow measurement texts.

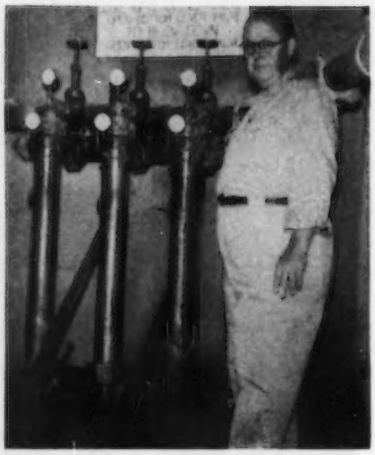
William A. Ritchie, 58, a production superintendent for the Marathon Corp., Menasha, Wis., died December 30.

Anthony C. Taccetta, 63, died of pneumonia December 23 in Holy Name Hospital, Teaneck, N. J. He was president of the Franconia Paper Co., manufacturers of writing paper in East Paterson, N. J., and Lincoln, N. H.

John E. Hanny, 70, one-time vice president of Crown Zellerbach Corp., died January 3 of a heart attack in Portland, Ore.

Mr. Hanny spent 42 years with Crown Zellerbach. He was resident manager of the C-Z plant at West Linn from 1926 to 1930 and was resident manager of the C-Z plant at Camas, Wash., from 1930 to 1947. He was made a vice president in charge of all manufacturing in 1947. He retired in 1952.

Filters Solve Shower Maintenance Problem



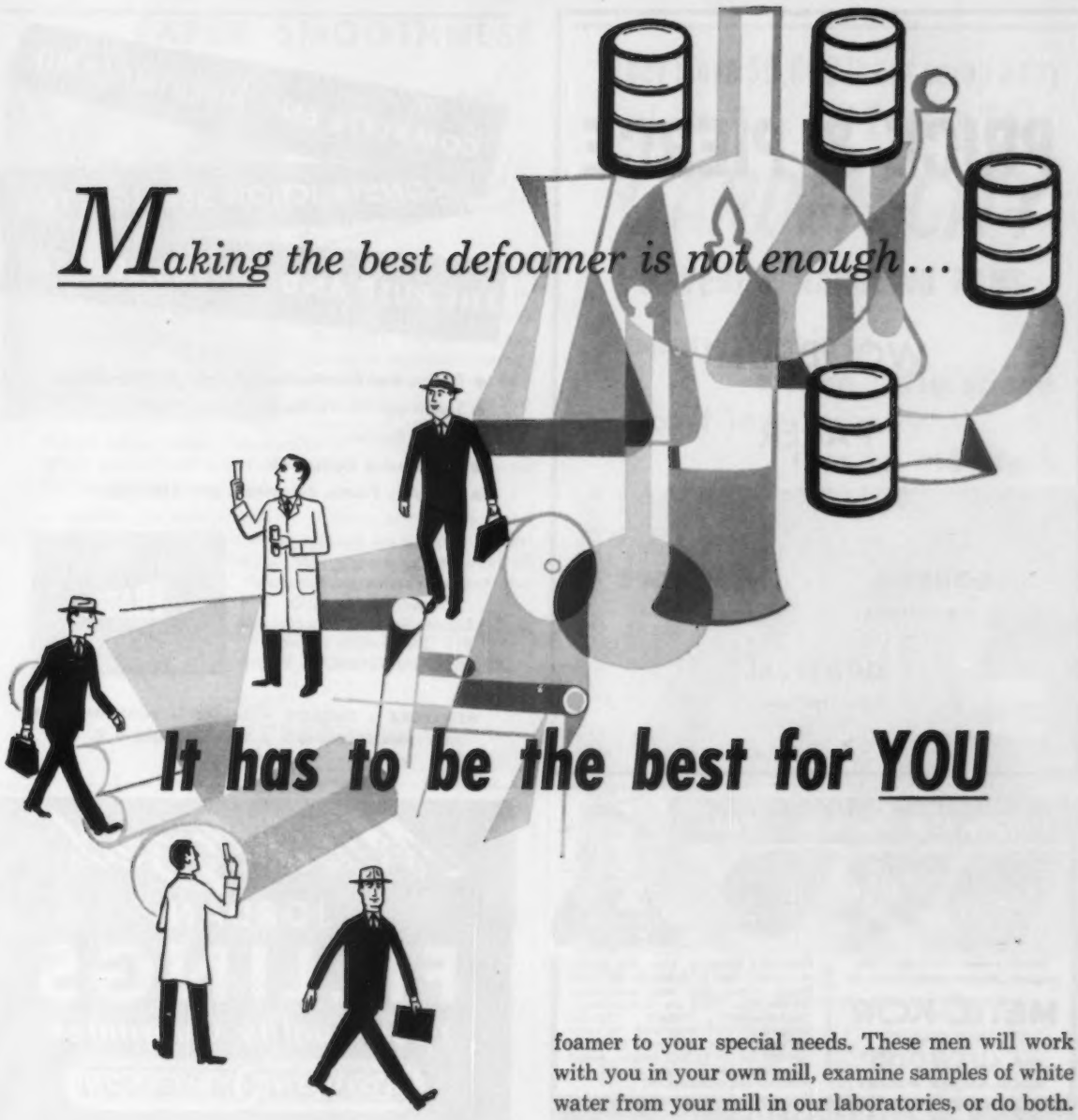
The Sall Mountain Division of Nicolet Industries reports complete satisfaction with its Ronningen Multiplex Filter system. In operation continuously for the past two years, these filters are utilized to prevent fines in clarified water from working into the showers.

The mill manufactures asbestos paper for pipe covering gaskets, and insulation, and the nature of the asbestos is such that continual and thorough cleaning of the cylinder molds is required. Cleaning of the molds is accomplished with high-pressure low-volume showers using clarified water from a flocculating sedimentation type saveall system. To prevent fines from working into the showers, a bank of three Ronningen filters was installed prior to the showers. These filters have reduced maintenance on the showers, and prevent plugging of the nozzles.

The filters require only a very minor amount of maintenance consisting of an occasional backwash and blow-down. Quick acting valves allow this to be accomplished in a minimum of time. The filters of non-corrosive construction, may be quickly dismantled and are said to be non-short circuiting, that is, there is no possible means to by-pass the filter elements.

Other uses for the Ronningen filter include the protection of rotameters, rotary shaft seal water, glue systems and general plant process water.

The job you want may be waiting for you in our Classified Advertising section — Have a look.



Making the best defoamer is not enough...

It has to be the best for YOU

Every paper mill must control foam—with the greatest possible efficiency—at the lowest possible cost. And since each mill differs so widely from every other mill, Nopco's Paper Division spares no effort to make certain we have a defoamer—whether paste, liquid, or flake—that will effectively, economically control foam in *your* mill.

But making the best defoamers is not enough. Nopco's technical staff has the breadth of experience that can be invaluable to you in fitting the right defoamer to your special needs. These men will work with you in your own mill, examine samples of white water from your mill in our laboratories, or do both.

You can't be sure you've attained *maximum defoaming efficiency at the lowest cost per ton* until you have the best "team" in the business, the Nopco technicians, prescribe from the widest range of defoamers in the business—the Nopco defoamers. Write today for a free booklet on Nopco defoamers. Nopco Chemical Company, Harrison, New Jersey.

NOPCO

PLANTS: Harrison, N. J.
Cedartown, Ga. • Richmond, Calif.
London, Canada

PRICE & PIERCE
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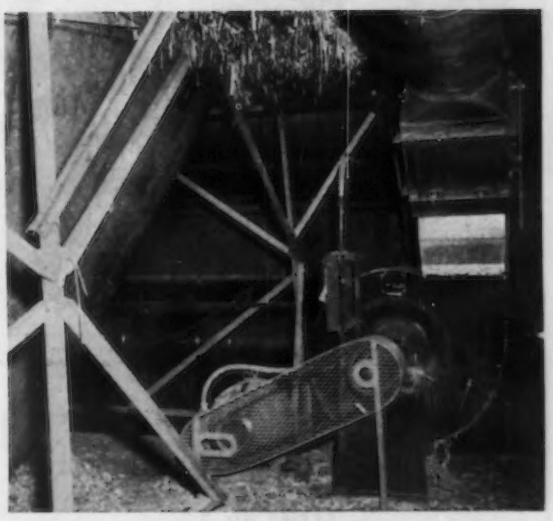

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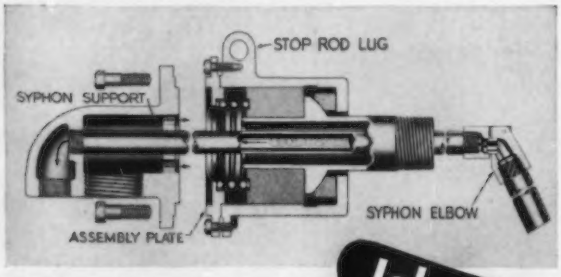

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1—Set B. and C. Crownless deflectionless main press rolls 22" dia. x 128" face R.C. Complete with A.F. brgs, framing, Foxboro Controls & rt. angle drive with clutch & pulley.
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2—98" x 18" Press Section. Complete.

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1—Warren 94" Machine winder—60" rolls.
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While we strive for accuracy in preparing the above index which is purely a service to our readers, we cannot be responsible for errors.

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Mill subscription survey reveals over 6 readers per copy of PAPER TRADE JOURNAL

The Question

Periodically the editor of PAPER TRADE JOURNAL writes to companies which have mill subscriptions to PAPER TRADE JOURNAL to find out who reads these mill copies. The request reads as follows:

> **"Your mill subscribes to at least one copy of PAPER TRADE JOURNAL in the name of the mill. You can be of tremendous help to me if you will indicate below just who reads these mill copies."**

The Response

Two hundred and six replies were received, of which 182 showed the breakdown requested. These replies indicated 1,213 mill readers, an average of 6.67 readers per mill copy.

The Results

Analysis of the titles of readers show the following breakdown:

Officers	10.4%
Mill managers, including superintendents	18.2%
Assistant managers	5.2%
Technical directors	24.6%
Engineers	16.4%
Purchasing Agents	3.3%
Foremen	5.5%
Department heads, etc.	16.4%
Total	**100.0%**

The Projection

Applying this percentage breakdown to all mill subscriptions and projecting the average of 6.67 readers per mill subscription, the following readers are indicated:

Officers	694
Mill managers, including superintendents	1,215
Assistant managers	347
Technical directors	1,643
Engineers	1,095
Purchasing Agents	224
Foremen	367
Department heads, etc.	1,095
Total	**6,680**

The Individual Subscribers

In addition to mill subscriptions, 2,979 individual mill men subscribe to PAPER TRADE JOURNAL. Counting these at one reader per copy, the breakdown is as follows:

Officers	441
Mill managers, including superintendents	555
Assistant managers	208
Technical directors	322
Engineers	362
Purchasing Agents	57
Foremen	541
Department heads, etc.	493

Total Indicated Readership

When indicated readers are added to individual subscribers, we note the following totals:

Officers	1,135
Mill managers, including superintendents	1,770
Assistant managers	555
Technical directors	1,965
Engineers	1,457
Purchasing Agents	281
Foremen	908
Department heads, etc.	1,588
Total	**9,659**

Conclusion

The unusually high readership per mill copy, combined with individual mill subscriptions, goes far toward explaining the fact that PAPER TRADE JOURNAL rates as the most useful publication in the field among mill men.

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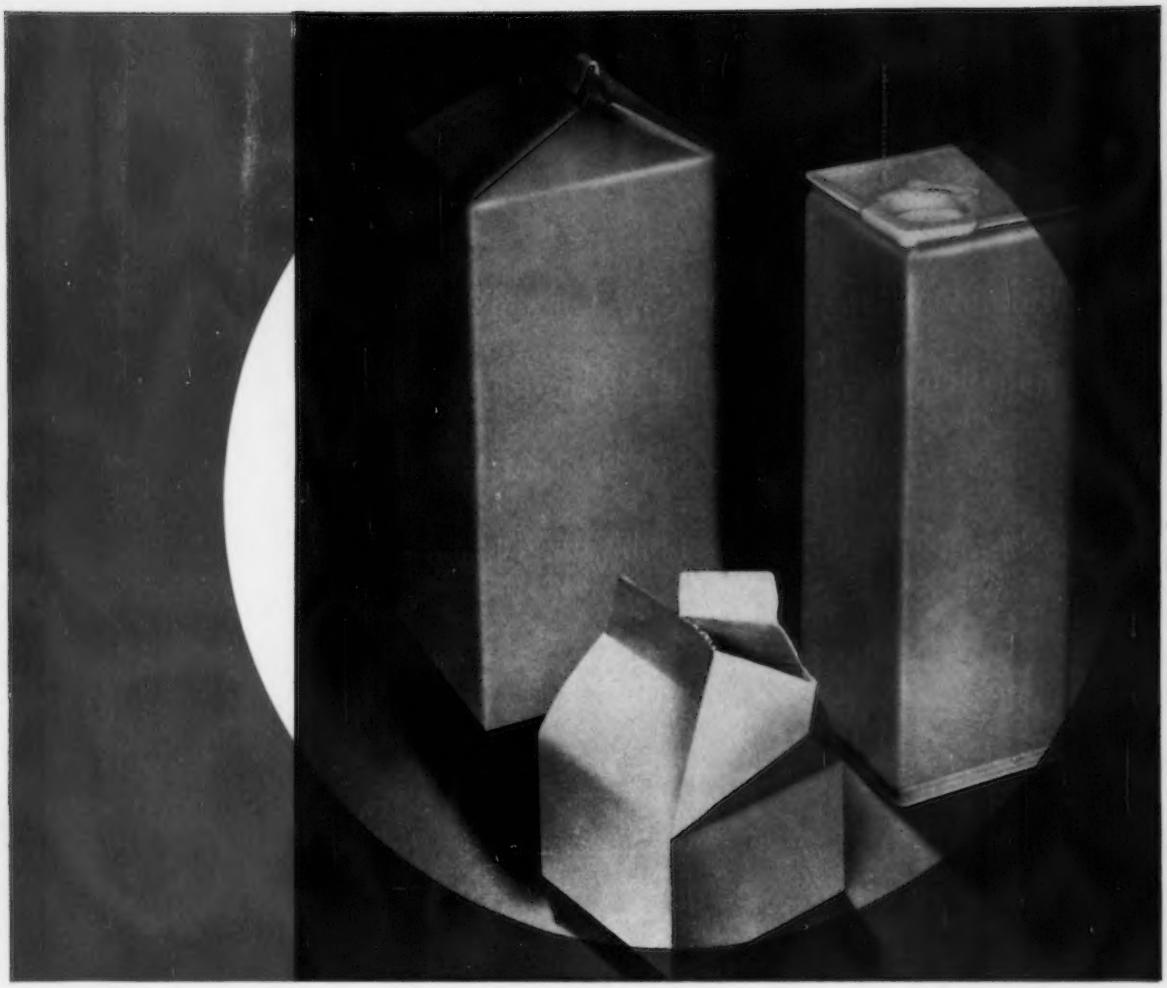

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